SUMMARY OF THE 1984
FOREST AND RANGE RESOURCE ANALYSIS

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The 1984 Forest and Range Resource Analysis was prepared by the Ministry of Forests' Strategic Studies Branch with the assistance of numerous staff members from throughout the ministry. Additional contributions were made by other government agencies and members of the forest and ranching industries. Background papers to certain parts of the report, including integrated use, regional economic profiles, international timber supplies and selected topics related to the forest industry, were prepared by private consultants.

A panel of senior Ministry of Forests' staff provided advice on content of the report and accuracy of interpretation of ministry policies. Editorial assistance was provided by Carter Communications Ltd., Vancouver, B.C.

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INTRODUCTION

The Forest and Range Resource Analysis[1] is a major source of current information that can be used to develop, revise and refine policies regarding the use of forest and range resources. It is part of the Ministry of Forests' management system, which enables the requirements of the *Ministry of Forests Act* to be fulfilled in an orderly way. Other components include the Five-Year Forest and Range Resource Program, the Annual Budget and the Annual Report.

In accordance with the *Ministry of Forests Act (Section 7)*, the Forest and Range Resource Analysis includes a resource inventory, enumerates nonproductive and underproductive areas, describes the ministry's programs, analyzes trends, forecasts demand and supply and discusses questions of public policy. It focuses particularly on the major resource management issues of the 1980's in light of the resources' present extent and condition.

The ten sections of the main report are covered in this summary's four sections:

Section 1. The present extent and condition of the resources;

Section 2. An analysis of present resource management policies and programs;

Section 3. Trends and opportunities for the future;

Section 4. Major policy implications for forest, range and recreation management.

For the resource analysis, the province was divided into eight units (Figure 1). These are based on the six Ministry of Forests' administrative regions with Prince George and Prince Rupert Forest Regions each divided into two. Some boundaries have been changed since the 1979 Resource Analysis but these are insignificant for statistical comparisons except for the pending boundary change between the Vancouver and Prince Rupert Forest Regions. This will result in the Mid-Coast TSA, which is part of the Prince Rupert Forest Region, becoming part of the Vancouver Forest Region. Statistics in this report are based on the revised boundary.

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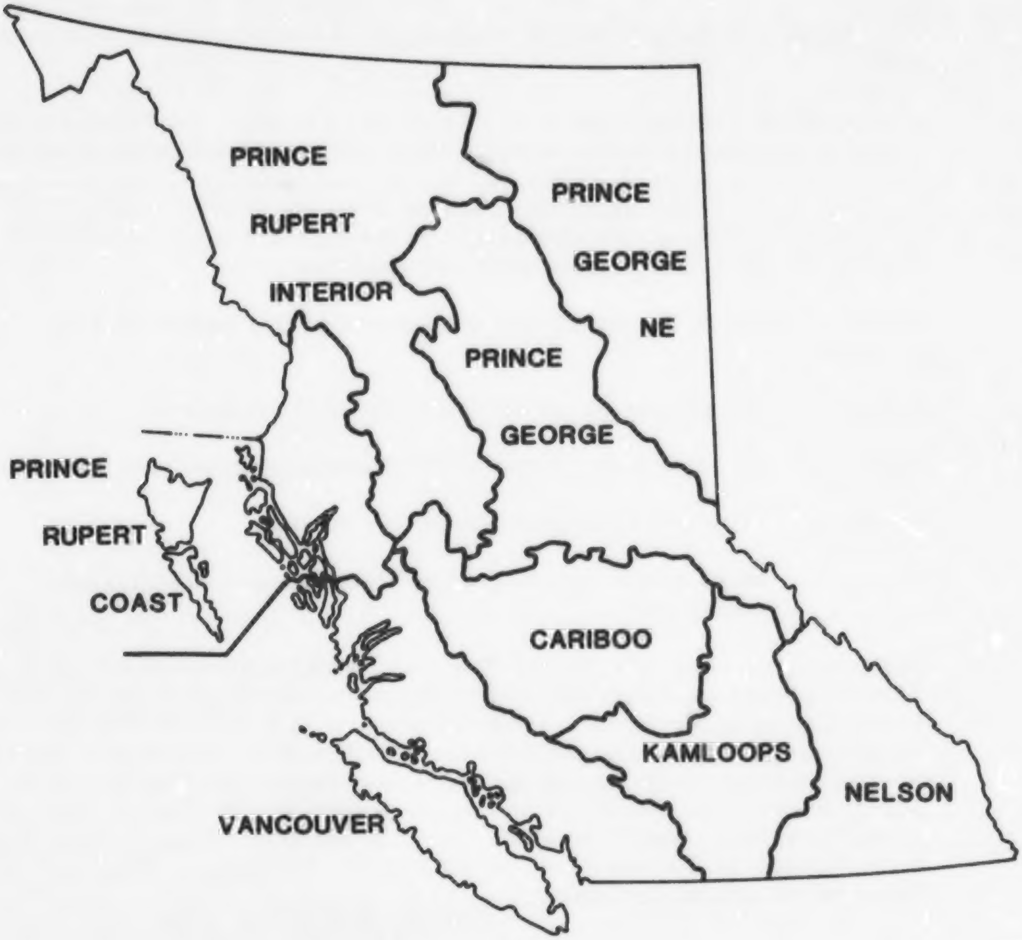
[1] The 1984 Forest and Range Resource Analysis is a comprehensive 400-page report submitted to the Legislative Assembly to meet the requirements of the *Ministry of Forests Act*. It provides more technical detail and more background information than this summary. The report is available from the Queen's Printer at $25 per copy.

Figure 1. Boundaries of Resource Analysis Regions


PRINCE
RUPERT
INTERIOR
PRINCE
GEORGE
NE
PRINCE
GEORGE
PRINCE
RUPERT
COAST
CARIBOO
KAMLOOPS
NELSON
VANCOUVER

SECTION 1

Extent and Condition of Timber, Range and Recreation Resources

This section summarizes the extent, quality, condition and use of public and private forest and range land. This information provides the background for later discussions of resource management and policy issues.

RESOURCE INVENTORIES

Land Base for Timber Production

Table 1 illustrates how much of the province's land area is available to support the forest industry. Any forms of land tenure, such as parks and Crown grants (private land), that preclude Ministry of Forests' management are considered alienations and are therefore excluded from the Crown land base.

To estimate how much forest land actually supports timber production, the total forested area of the province is reduced by subtracting areas that, for some reason, are expected to be unavailable. This 'netting down' process is the same as that followed in preparing Timber Supply Area (TSA) yield analyses and Tree Farm Licence (TFL) management and working plans.

First, the area of productive 'Forest Land' is determined. This includes all unalienated treed land that *could* produce a commercial timber crop. This area--43.3 million ha--is then reduced by the area that cannot be logged for a variety of environmental and economic reasons. This leaves 22.6 million ha of 'Net Productive, Available and Suitable' forest land. But additional deductions, expected when the management and working plans are reviewed over the next five years, will reduce that area by a further 1.3 million ha to 21.3 million ha. This figure must be interpreted with some caution, however, for the following reasons:

1. When forested land is only partially available for timber harvesting, as when environmental constraints limit a site's growth potential, its area is recorded as the equivalent of 100% available land. For example, 100 ha of 50% available forest land would be recorded as 50 ha.

2. Lands classified as Not Satisfactorily Restocked (NSR) are deducted in total, but they include as much as 2 million ha that upon resurvey will be reclassified as adequately reforested.

3. **The ability to log on the net land base depends on the ability of the remaining forest land to protect watersheds and wildlife habitats and to meet the many other conditions needed for integrated forest management.**

Table 1. Summary of Forest Land Area: TSAs and TFLs

		Area in Hectares
TOTAL AREA - Excluding major parks		88,907,918
Alienations		
- Crown Grants		
- Parks		
Total Alienations	6,938,022	
UNALIENATED AREA		81,969,896
Non Forest		
- Alpine Forest		
- Water		
- Open Range		
Total Not Productive	38,705,293	
FOREST LAND		43,264,603
Land Losses Accounted For in TSA Reports		
- ESAs and Land Withdrawals		
Total Not Available	2,383,746	
AVAILABLE FOREST LAND		40,880,857
Not suitable		
- inoperable		
- problem forest types		
Total Not Suitable	14,713,917	
POTENTIALLY PRODUCTIVE AVAILABLE AND SUITABLE		26,166,940
Not Stocked		
- NSR/DSD		
- NC		
Total Not Stocked	3,560,368	
PRESENTLY PRODUCTIVE AVAILABLE AND SUITABLE		22,606,572
Land Losses Not Accounted For in TSA Reports		
Total Additional Not Available	1,316,226	
NET PRESENTLY PRODUCTIVE AVAILABLE AND SUITABLE		21,290,346

Projected withdrawals in this Analysis are approximately one-third less than those estimated in the 1979 Resource Analysis. This lower estimate is due to refinements which resulted from the deferred area planning process associated with the creation of Provincial Forests.

In the Cariboo region, land withdrawals over the next 20 years are estimated at 188,000 ha. An additional 114,580 ha are now being processed for a total of 302,580 ha. In comparison, the 1979 Resource Analysis estimated that 343,000 ha of productive forest land would be removed from the forest land base over 20 years. Under the Deferred Planning Area Program, about 250,000 ha were identified for allocation to nonforest uses of which about 100,000 ha previously would have been considered long-term productive forest land. These areas should accommodate nonforest use for some years to come and reduce pressure on the remaining productive forest land base.

In the Kamloops region, withdrawals are estimated at 194,000 ha over the next 20 years plus 10,501 ha now being processed for a total of 204,501 ha. The dramatic increase over the 1979 estimated withdrawals of 99,000 ha is due to the inclusion of 110,000 ha of park and miscellaneous major land reallocations.

In the Nelson region, future land withdrawals over the next 20 years are estimated at 137,000 ha plus 11,544 ha how being processed for a total of 148,544 ha. During the past 5 years, an estimated 61,500 ha has been removed from the forest land base. The bulk of the area was removed through the creation of Valhalla Park (50,000 ha). No further comparably large withdrawals are anticipated in the next 20 years. Projected withdrawals in this Analysis compare favorably to the 1979 Resource Analysis estimate with the slight reduction due to refinements in the estimated withdrawals for individual TSAs.

In the Prince George Northeast region, withdrawals over the next 20 years are estimated at 272,000 ha, plus 91,956 ha now being processed, for a total of 363,956 ha. This is well below the 1979 estimate that 596,500 ha of productive forest land would be removed from the forest land base over 20 years.

In the Prince George region, land withdrawals are estimated at 268,000 ha over the next 20 years plus 135,670 ha lost over the past 5 years, for a total of 403,670 ha. This is close to the 1979 Resource Analysis estimate of 412,500 ha. Recent work on defining forest and nonforest areas resulted in identification of about 128,000 ha for nonforest use. Of this, approximately 71,500 ha would have previously been considered long-term productive forest land.

In the Prince Rupert Interior region, withdrawals of productive forest land over the next 20 years are estimated at 128,000 ha plus 11,373 ha now being processed, for a total of 139,373 ha. This is significantly less than the 1979 Resource Analysis estimate of 289,000 ha. A large part of the difference is due to the reclassification of land from accessible to inaccessible.

In the Prince Rupert Coast region, future withdrawals over the next 20 years are estimated at 214,000 ha plus another 1,083 ha now being processed, for a total of 215,083 ha. This is significantly less than the 1979 Resource Analysis estimate of 435,480 ha of productive forest land (adjusted for the

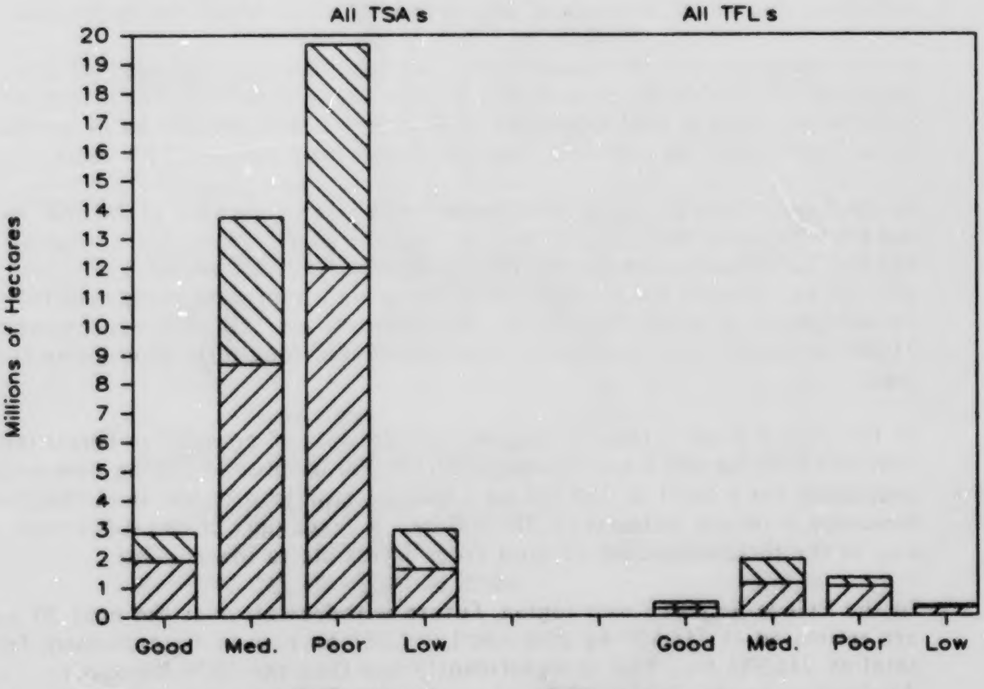
boundary change that moved the Mid-Coast TSA to the Vancouver Region). Actual losses during the five-year period since these estimates were made include only the lands now being processed. Although the level of allocations to other uses predicted in 1979 will probably not be reached, they will still be high due to the value and importance of other resources.

In the Vancouver Region, future withdrawals are estimated at 18,000 ha, and 14,519 ha of withdrawals are now in process, for a total of 32,519 ha. Actual recorded losses since 1979 are approximately 14,500 ha or 21% of the 1979 estimate. Much of this loss occurred in the form of *Land Act* tenures and park acquisitions within the boundaries of the Vancouver Forest Region as it existed in 1979.

Timber Resource

The province's forest lands are classified according to their ability to grow timber into good, medium and poor site classes. Poor sites predominate but more timber is produced on good and medium sites. Figure 2 shows the forest area by site class.

Figure 2. Distribution of Forest Area by Site Class



The 28 commercial tree species in British Columbia have been grouped into 42 well-defined associations of *Inventory Type Groups*. These groups are assigned a numeric code and named according to the dominant or leading species represented in that area. Occasionally, a stand contains two almost equal species. The resulting type group name then combines both the leading and secondary species.

Inventory type groups with common leading species can be combined into *growth types*. For the purpose of this Resource Analysis, the following ten growth types are defined:

Type Groups	Growth Types
1 - 8	Fir
9 - 11	Cedar
12 - 17	Hemlock
18 - 20	Balsam
21 - 26	Spruce
27	Western White Pine
28 - 31	Lodgepole Pine
32	Ponderosa Pine
33 - 34	Larch
35 - 42	Deciduous

Although tree species are most commonly found in association with their respective growth types, this does not preclude their occurrence in stands of other growth types. For example interior Douglas-fir commonly occurs in the ponderosa pine growth type and cedar can be found within the hemlock growth type.

Table 2 shows the timber volume in each growth type. Because data for Tree Farm Licences is collected differently from data for Timber Supply Areas, it cannot be presented in a comparable manner. To show volume by growth type, the volume for all site classes and ages had to be lumped into a single total. For an indication of Tree Farm Licence inventories by site and age, refer to the area statistics in Figure 2.

In this Resource Analysis, computer modelling techniques were used to project the changing characteristics of the forest over time. Both the gross and net forest land bases were examined to determine trends in age and species structure in each region over the next 100 years. As Figure 3 shows, the proportion of younger-aged stands increases markedly on the net forest land base, but the age classes are relatively stable on the gross forest land base. This finding is important to debates about the effects of logging on old-growth forests and related ecological balances. While it confirms that older forests will be reduced in heavily logged areas, it also indicates that the effects of logging will not be as pervasive as many expect.

Table 2. Inventory of Timber Volume by Growth Type ('000 m^3)

Timber Supply Areas

Mature

Growth Types	1-8	9-11	12-17	18-20	21-26	27	28-31	32	33-34	35-42	Totals
Site Cl.											
Good	35905	5324	30411	29714	284355	25	362851	69	4713	9146	762872
Med.	136274	153834	402586	347767	740465	848	761928	1453	10281	282114	2837550
Poor	121861	366489	576739	613090	442702	9371	428494	4801	3115	63366	2630029
Low	592	88681	2279	27040	16613	1253	2950	103	10		139520
Total	294632	614328	1012015	1017611	1484135	9767	1556223	6426	18119	354626	6367881

Immature

Growth Types	1-8	9-11	12-17	18-20	21-26	27	28-31	32	33-34	35-42	Totals
Site Cl.											
Good	96795	653	10244	5538	84362	714	35718	1325	10356	3498	249203
Med.	150430	10696	51846	32719	181489	719	162862	1814	22334	63719	678628
Poor	61806	4676	23125	88621	130053	120	109841	1199	3998	38835	462274
Low	541	68	1	5135	1830	14	3049	14	8	0	10658
Total	309571	16093	85216	132013	397734	3657	311469	4352	36697	106052	1402853

Mature and Immature - All Sites

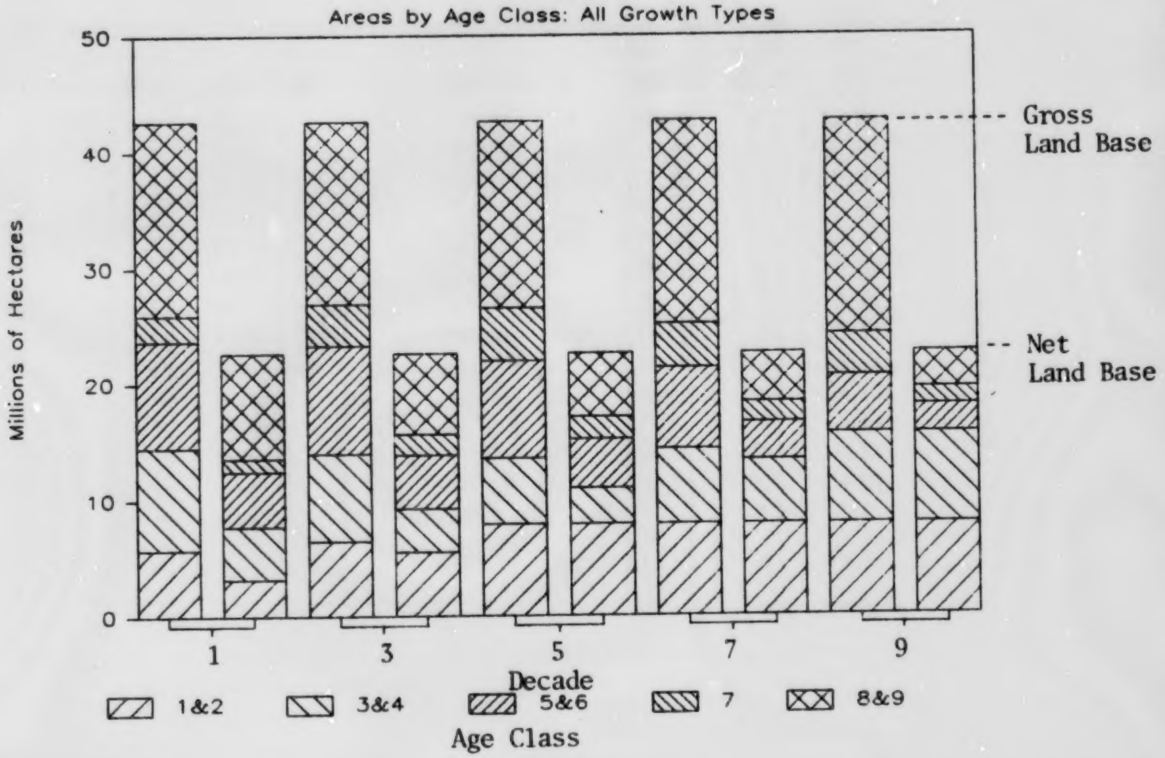
Growth Types	1-8	9-11	12-17	18-20	21-26	27	28-31	32	33-34	35-42	Total
	604204	630421	1097230	1149624	1881869	13424	1867591	10778	54816	460678	7770734

Tree Farm Licences

Mature - All Sites

Growth Types	1-8	9-11	12-17	18-20	21-26	27	28-31	32	33-34	35-42	Total
	66329	300644	578634	242890	107712	4131	31441	169	2504	5484	1339940

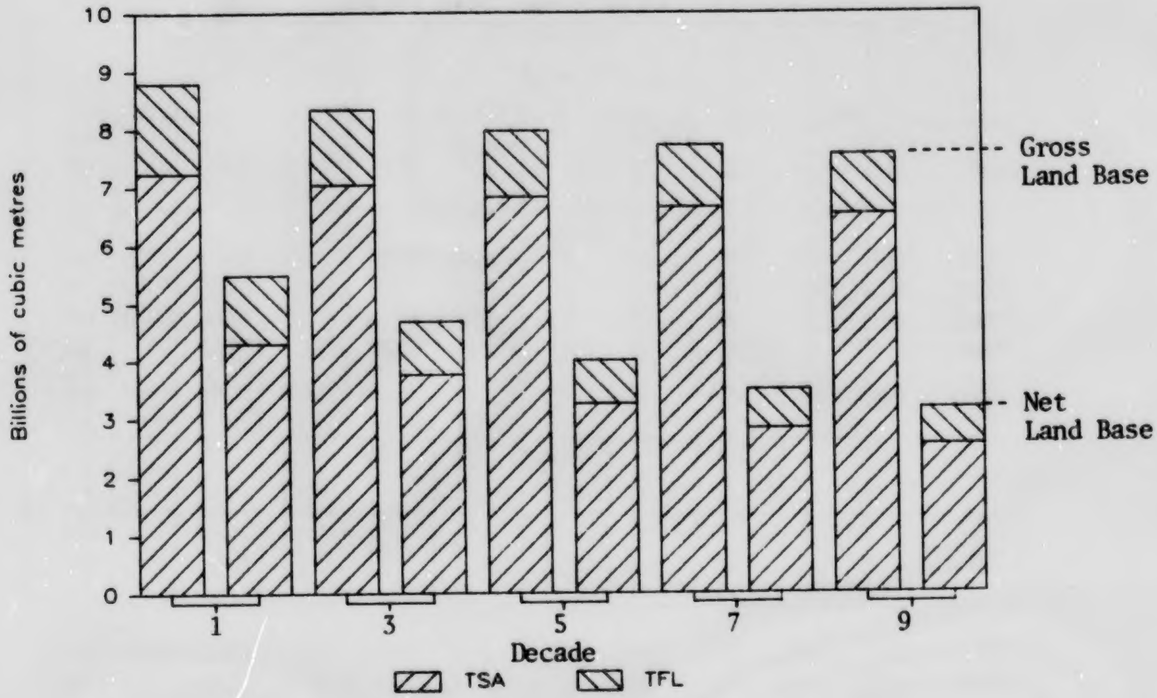
Figure 3. Projected Changes in Age Structure of the Forest



The volume of the growing stock was also examined. As Figure 4 shows, the volume will decline as younger stands replace mature stands. However, the growth rate will be higher since younger stands grow more rapidly than mature ones. So, while less timber will be available for harvest, the reduction will not be as great as the reduction in standing volume. On average, the timber available for harvest is projected to decline by 3% over the next 20 years, by 10% over the next 50 years and by 14% over the next 100 years, providing the standard of silviculture is increased to meet the basic criteria assumed when current allowable annual cuts were established.

These results confirm the findings of the first Resource Analysis that annual harvests will gradually decline as old-growth stands are replaced by second-growth stands. If harvests on unregulated private lands also decline, this reduction will be even greater.

Figure 4. Projected Changes in Volume of Growing Stock



No significant trends can be detected in species composition on the gross or net land base when mature *and* immature stands are combined. However, the species composition of *mature* timber will change. Notably, the spruce group will decline from 25% of current harvests to 11% over 100 years. The lodgepole pine group replaces hemlock as the major component in the harvest after 50 years, moving from 20% at present to 33% over 100 years.

Range Resource

An inventory of range resources has yet to be completed, but an approximation was generated for the 1984 Resource Analysis using the known correlations between forest cover type and forage production potential. Fourteen general range types were identified and their carrying capacities estimated. Table 3 shows the provincial summary of the range inventory.

Table 3. Provincial Summary of Range Inventory

Number	General Type	Area (ha)	%	Utilized Crown Range(ha)	% Area of Type Utilized	Actual Use AUM
1	Open Range	341,736	0.4	221,232	64.7	122,293
2	Wetland	1,677,290	2.0	275,299	16.4	61,077
3	Alpine	24,040,843	29.0	277,400	1.2	17,394
4	Ponderosa Pine Forest	101,619	0.1	56,104	55.2	18,597
5	Dry Forest	3,663,635	4.4	1,228,399	33.5	206,219
6	Lodgepole Pine Forest	9,663,204	11.7	1,799,203	18.6	112,569
7	Wet Forest	21,791,475	26.3	630,398	2.9	19,121
8	Deciduous Forest	3,817,059	4.6	1,420,057	37.2	76,285
9	Transitional	8,610,723	10.4	1,894,299	22.0	185,075
10	Clearings	167,732	0.2	95,334	56.8	76,293
11	Non-Vegetated	2,611,092	3.2	6,251	0.2	180
12	Brush	1,848,142	2.2	386,882	20.9	19,246
13	Urban	127,563	0.2	32,045	25.1	9,773
14	Alienated	4,398,277	5.3		0.0	
Unit Total		82,860,390	100.0	8,322,903	10.0	924,122

Characteristics of each of the 14 general range types are presented below.

Open Range: Open Range is found within the Ponderosa Pine-Bunchgrass and dry phases of the Interior Douglas Fir biogeoclimatic zones. Plant growth is dominated by a variety of grasses and forbs. Widely scattered ponderosa pine and Douglas-fir veterans may also be present. Within the elevation range of 700 - 900 m, there are three elevational gradations: lower, middle and upper grasslands. These exhibit characteristic levels of productivity under climax conditions ranging from about 550 to 1,120 kg of air-dry forage per hectare. Although these areas are generally small, they are highly productive.

Water is a critical element on these sites because supply from both rainfall and snowfall is limited (approximately 300 mm of rain and 100 cm of snow annually). The rich organic soils that underlie these grasslands are highly susceptible to disturbance.

The lower elevational open rangelands are particularly important to the ranching industry primarily for livestock grazing during the spring and fall. These sites must be managed carefully as they correspond to classes 1 and 2 wildlife habitat and are susceptible to degradation by over-grazing as cattle and wildlife compete for browse.

Wetland: Wetland types are typically associated with the Englemann Spruce-Subalpine Fir and Interior Douglas Fir biogeoclimatic zones. Sedges and rushes dominate the vegetative layer. As these sites are usually underlain by imperfectly drained organic soils, moisture is not a critical factor.

Wetlands are used for summer grazing when soil moisture is low enough to allow cattle on the sites. Typically, these areas are small but highly productive. Forage productivity ranges from 1,500 kg air-dry per hectare to more than 4,000 kg.

Alpine: The alpine range type is typically associated with the Alpine Tundra biogeoclimatic zone and is dominated by low shrubs, grass and sedge species. Very stunted and shrubby forms of subalpine fir, Englemann spruce, and western and lodgepole pine occasionally occur.

Water is not as critical an element on these sites as it is in open range areas. Typically, annual rainfall is about 600 mm and snowfall about 400 cm. The soil on these sites is very sensitive to erosion because it is thin and the topography is usually rugged. The short growing season is a limiting factor in the ability of the range to produce forage.

The grass-sedge communities at lower-elevation alpine range provide an important source of late summer forage for cattle. These areas are fairly productive but must be well managed because over-grazing will quickly lead to accelerated soil erosion.

Ponderosa Pine Forest: The Ponderosa Pine Forest type is generally found within the Ponderosa Pine-Bunchgrass biogeoclimatic zone and is dominated by ponderosa pine with Douglas-fir. Grasses dominate a poorly developed shrub layer.

As with the open range type, water is scarce and limits forage productivity. Rainfall is approximately 300 mm and snowfall about 100 cm annually.

This type is important to the ranching industry. Primary use occurs during the winter, early spring and late fall. Typically, these sites are potential producers of high-quality forage. However, because they are so susceptible to degradation, grazing must be carefully managed.

Dry Forest: The Dry Forest type is generally associated with dry subzones of the Interior Douglas Fir biogeoclimatic zone and comprises a mixture of Douglas-fir and lodgepole pine, and to a lesser extent western larch and ponderosa pine. Pinegrass and associated forbs comprise the herb layer.

Water supply is not a critical element in these areas. Precipitation is normally near 600 mm per year and snowfall about 300 cm.

This type is primarily used as summer range. Productivity is good (averaging about 273 kg air-dry per hectare) but declines rapidly as the summer progresses. Adjacent dense forests provide good bedding cover. Because this type is moderately sensitive to disturbance, it should be carefully watched to prevent over-grazing.

Lodgepole Pine: This type occurs extensively throughout British Columbia in a number of different biogeoclimatic zones including Interior Western Hemlock, Interior Douglas Fir and Englemann Spruce-Subalpine Fir.

Water supply, particularly in areas located within the Englemann Spruce-Subalpine Fir zone, is not as great a limiting factor as it is in the Dry Forest type.

Summer grazing is of particular importance on these sites. Productivity ranges from zero at high stand density to about 550 kg air-dry per hectare at lower stand density. In some areas, burning and thinning are used to increase productivity. A great potential exists for wildlife-cattle conflicts in the Lodgepole Pine type as it is used extensively as wildlife habitat.

Wet Forest: The Wet Forest type is usually associated with the Montane Spruce and Interior Cedar Hemlock biogeoclimatic zones and is formed of a varied mixture of coniferous species. The predominant species are normally Englemann spruce, lodgepole pine, subalpine fir, cedar and western hemlock.

Water supply is not a critical element on these sites since rainfall generally averages about 700 mm annually and snowfall approximates 500 cm per year.

Clearcuts are used extensively for summer grazing, and dense lodgepole pine stands provide good browse. Because of the competition for browse, a substantial potential exists for conflicts between cattle and wildlife on these sites.

Deciduous Forest: This type, located primarily in the Peace River area, is the forest type that provides the best grazing because it has a rich understory. Both the herb and shrub layers are rich in nutrients and water is not a limiting factor. Much of the summer grazing in these locations occurs on cultivated community pastures.

Transitional: These locations are classified as either nonproductive, disturbed or not satisfactorily restocked to a forest crop under the forest inventory system. The sites vary widely as to vegetative species and soil moisture, and their value as livestock grazing range varies accordingly. For example, in the Peace River area these sites are heavily used by livestock, but the transitional areas in the Mid-Coast portion of the province are noncommercial or nonproductive types that do not provide any opportunity for grazing.

Clearings: These areas are typically associated with the Wet Forest type. The description of that type applies equally well to the Clearings type.

Nonvegetated: This type supports only a very small livestock population.

Brush: The brush type occurs ubiquitously throughout the province and varies widely in its potential for grazing, but it does not provide good grazing range in any area.

Alienated: Alienated land (private) provides much of the most productive grazing in the province but, because it is not under Ministry of Forests' management, it is not included in this report in the estimates of utilized range.

Urban: The urban classification includes a wide variety of sites such as industrial areas, pipelines and power lines. Some of these may be seeded and can provide significant grazing opportunities. Others, where there is more intensive industrial activity, provide only limited use.

Recreation Resource

This is the first time land with forest recreational values has been inventoried. The inventory identifies current recreational uses and demands as well as natural or cultural features that could generate a recreational experience.

Table 4 shows the amount of Crown land within timber supply areas and within five tree farm licences (Tree Farm Licence Nos. 3, 5, 8, 14 and 23) that has recreational value. For the Crown portion of other tree farm licences, no comparable information is available. (Federal lands, provincial parks, Park Act Recreation Areas, Indian Reserves, municipal areas and private alienated lands are not included.)

Table 4. Provincial Summary of Recreation Inventory

(All TSAs plus TFL Nos. 3, 5, 8, 14 and 23)

	Land Areas With Special Areas of Recreational Values			Land Areas With Normal Recreational Values	Total
Type of Area	Visual	Water	Other		
			(millions of hectares)		
Commercial Forest Land	4.10	2.82	2.42	32.46	41.80
Noncommercial Forest Land	0.92	0.50	1.07	4.45	6.94
Nonforested Land	1.63	0.80	3.80	32.87	39.10

'Areas with special recreational values' are those with a management class rating. This means that special management is needed to protect and maintain their generally medium-to-high recreational values. 'Areas with normal recreational values' include all other areas.

The freedom of members of the public to enter Crown land to enjoy recreational activities is part of the province's heritage and is an important element in its recreational appeal. Since most recreational activity takes place in the vicinity of roads, access development and management is a key factor in forest and wildland recreation management. Table 5 shows how much Crown land is now accessible by road and how much more will become accessible in the next 20 years as a result of forestry operations.

Table 5. Forest and Wildland Accessible by Roads

Type of Area	Total Area (million ha)	% currently accessible	% planned within 20 years
Commercial Forest Land	41.80	57	18
Noncommercial Forest Land	6.94	37	14
Nonforested Land	39.10	35	14

Currently, accessible lands do not include areas beyond the crest of a watershed or more than 8 km away from a seasonal four-wheel drive or higher standard road; and where a four-wheel drive or better road exists, it must have uninterrupted connection to the provincial highway system either over land or via a scheduled regular ferry system. Therefore, areas near inactive roads in isolated coastal inlets are considered currently inaccessible.

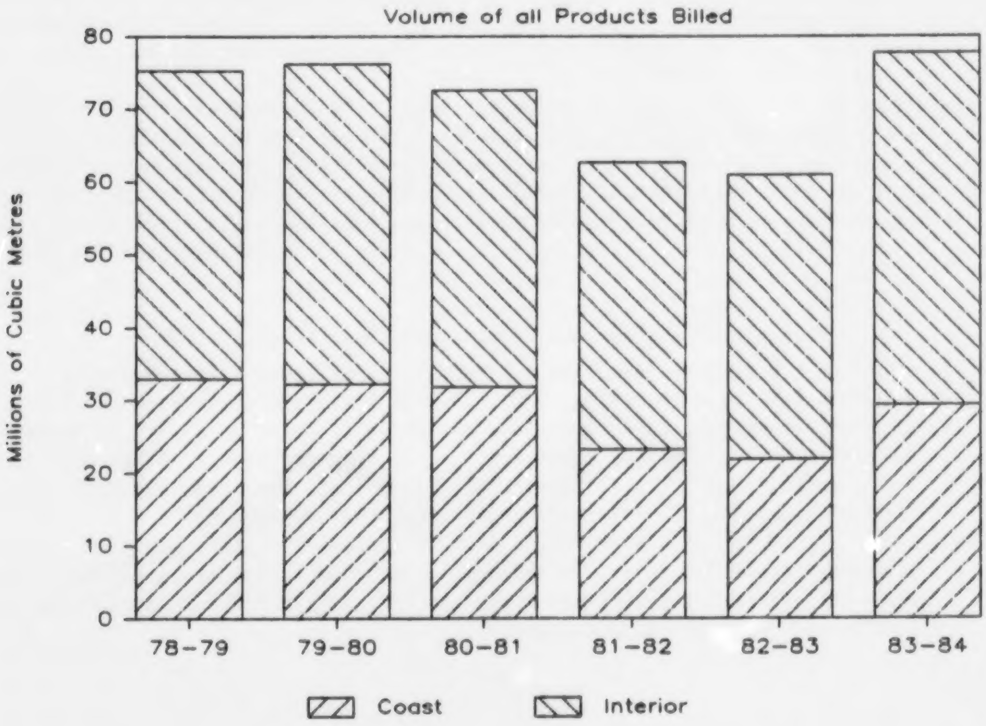
Although roads are currently the most important means of access, the expanding use of all-terrain vehicles and small aircraft may create new access management problems during the next ten years.

USE AND CONDITION OF THE RESOURCES

Timber Resource

Timber harvests over the past five years averaged over 71 million m^3 per year (Figure 5). Reduced harvests on the coast were offset by recent record harvests in the interior. An average of 176,000 ha were logged each year of which 85% were clearcut. The remainder was selectively logged.

Figure 5. Provincial Timber Harvests[1], 1979-1984



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[1] Includes all Crown land harvested and private land within government-issued tenures such as TFLs, Tree Farms and Woodlots. For consistency with earlier data, 1983/84 annual report data was adjusted to exclude 'Other Private Land'.

The condition of the timber resource is assessed by evaluating losses and gains in productivity over the past five years and by examining factors that may continue to alter productivity in the future.

Timber productivity can be reduced by lack of regeneration to a commercial species, insects, disease and decay, decadence and wildfires. Losses from these sources are documented in this Analysis to direct development of management programs and to establish a baseline for assessing future performance.

Forest Regeneration. Of particular interest are the statistics regarding not satisfactorily restocked (NSR) lands. NSR forest land has continuous inflows and outflows resulting from the restocking through natural and artificial regeneration and the denudation of other areas through logging and wildfires. NSR statistics can, therefore, only reflect the situation at a specific time, with periodic updates as new areas are sampled and others are resurveyed. It is not currently feasible or cost effective to sample all areas annually, although estimates of the changes occurring on unsurveyed areas can be made through the use of the regeneration factors.

Changes and improvements in survey techniques, sampling methodology, access management criteria and increased survey coverage have given us a much clearer picture of the current state of the timber resource. These same improvements, however, have made it difficult to compare current assessments with previous assessments of forest productivity and thus to determine changes over time.

Within the Ministry of Forests, NSR statistics come primarily from three sources: the Inventory Section of the Planning and Inventory Branch; the Silviculture Branch, which maintains the History Record System; and regional planning officers.

Inventory records cover all Crown land in the province and are based on aerial surveys supported by ground sampling. The historical records produced by Silviculture Branch are generally confined to sampled areas. This difference in survey techniques has resulted in a large difference in the amount of land classified as NSR within each system: 1.3 million ha in the History Record System versus 3.4 million ha in the inventory system. Both figures exclude tree farm licence data, which is submitted to the ministry separately by individual licensees.

Terminology between Branches also differs. Inventory considers areas of deciduous species and unevenly distributed coniferous species to be satisfactorily stocked, while Silviculture considers an area satisfactorily stocked only if it contains acceptable tree species and meets certain standards to do with the number of stems per hectare and the uniformity of their distribution. Stocking guidelines vary from one forest region to the next and may vary within each forest region based on site-specific considerations such as ecological classification, preferred and acceptable species, regeneration delay and end product objectives.

And, finally, their methods differ: Silviculture Branch applies additional factors to take into account expected natural regeneration on unsurveyed or infrequently surveyed land, which substantially reduces the area listed as NSR.

To represent the provincial NSR situation as accurately as possible, inventory data was modified to reflect the forest management criteria applied to silvicultural ground (regeneration) surveys. This involved dividing inventory data into NSR-current and NSR-backlog categories using the proportions found in the history record system and applying regeneration factors. (NSR-current includes land on which the accepted regeneration period has not elapsed - roughly three years on the coast and five years in the interior; NSR-backlog includes land that is not satisfactorily restocked after the specified regeneration period has expired.) The regeneration factors were derived from historical regeneration survey data and range from 25% to 60% (i.e. 75% to 40% of areas classified as NSR are expected to be stocked). On average, about 50% of all NSR lands and 40% of the good and medium site NSR lands turn out to be stocked upon field inspection. That is, they are incorrectly classified as NSR.

For the 1979 Resource Analysis, NSR/DSD/NCBr statistics were compiled on the basis of the Silviculture Branch History Records, inventory data where historical records were lacking, and local knowledge. This information was submitted by each forest district and tree farm licence holder and collated by a Resource Analysis task force. The total provincial NSR reported in this manner amounted to 1.92 million ha with 0.86 million ha on good and medium sites. When factored to allow for expected regeneration, these figures reduce to 1.10 and 0.64 million ha.

These same statistics were compiled for the 1984 Resource Analysis using inventory data, with current backlog breakdown and regeneration factors determined from History Record data. Tree farm licence holders again submitted their own information. The total provincial NSR calculated by this method amounts to 3.55 million ha with 1.23 million ha on good and medium sites. When factored to allow for expected regeneration, these figures reduce to 1.63 and 0.74 million ha. Table 6 compares the statistics between the two dates.

Table 6. Summary of NSR/DSD/NCBr Area: TSAs and TFLs

(hectares)

Forest	All Sites		Good & Medium Sites Only	
Region	1979	1984	1979	1984
Cariboo	174,400	158,900	110,400	100,800
Kamloops	150,400	193,600	107,000	141,000
Nelson	262,800	244,000	174,200	156,800
Prince George	823,700	2,142,800	292,400	632,700
Prince Rupert	419,100	703,000	98,500	120,300
Vancouver	94,300	111,500	80,500	77,600
Total before factoring*	1,924,600	3,553,900	864,000	1,229,200
Total after factoring	1,095,200	1,634,500	644,600	737,900

The 85% increase in unfactored NSR over five years is due mainly to the inclusion of survey data from remote northern portions of the Prince George and Prince Rupert Forest Regions, with the majority of the increase in poor and low sites. Growth projections on these and other poor and low sites in the province indicate that the returns on forest management investments are expected to be minimal or nil. Accordingly, only good and medium sites are considered to be economically treatable; the increase in this component of NSR lands on these sites amounts to 365,000 ha (42%), but after factoring the increase is only 93,000 ha, or 14%.

Averaged over the five-year period since the 1980 Resource Analysis, the increase in NSR translates to a loss of 19,000 ha per year or 9% of the area logged and burned annually. These figures do not include area lost to land alienation (parks, hydro reservoirs and rights-of-way, urban settlement, mining, environmental concerns or denuded poor and low sites not scheduled for planting).

History Records for the period 1979 to 1983 indicate that at least 80,000 ha of forest land scheduled for planting were not planted and were still classed as NSR by the end of 1983. Also, of the sites that were planted, only 50% were planted within the recommended period following denudation. These shortfalls resulted from a lack of available or appropriate planting stock or operational problems such as drought, excessive rain, restricted access and inadequate site preparation.

The average growth rate of immature forests on good and medium sites in the province expressed as a mean annual increment is approximately 3 m^3 per hectare. Thus, if the approximately 738,000 ha of good and medium site NSR were immediately restocked with commercial forest crops, the increase in net annual growth (close utilization less decay) would amount to 2.2 million m^3 per year. This growth is about 3% of the current annual allowable cut of 70.1 million m^3 per year from regulated lands including tree farms. Critical assumptions are that all of this area will be available for continued forest management and that no growth would have occurred on these areas without some form of management intervention.

In addition to those areas scheduled for planting but not planted, other areas could have reverted to, or retained, NSR status because of plantation failure or unforeseen delays in natural regeneration. This may partially explain the difference between the 80,000-hectare increase in NSR determined from the History Records and the 93,000-hectare increase in NSR indicated by survey data. Nonetheless, the figures are remarkably close and can be considered a reasonably accurate assessment of the increase in NSR since the 1979 Resource Analysis.

Brush Competition. Most of the good- and medium-site NSR forest land is encroached upon, or overtaken by, undesirable woody plants and noncommercial tree species. These lands are of special concern as they include some of the best growing sites and are among the most expensive to rehabilitate. Brushing problems also exist on some areas currently classified as satisfactorily restocked (SR). Extensive brushing and weeding or conifer release programs are needed to maximize the growth potential on these sites.

The Silviculture Branch released a comprehensive report on this subject in the spring of 1984. It estimates that brushing problems exist on 2.9 million ha of good- and medium-site NSR/DSD/NCBr, deciduous and SR types. Furthermore, it predicts that 49,000 ha will be added annually in the absence of an adequate vegetation management program. About 42% of the good- and medium-site current NSR, 66% of the good- and medium-site backlog NSR and 100% of the good- and medium-site noncommercial brush areas require treatment.

The report estimates that growth losses on forest lands invaded by brush exceed 8 million m^3 per year and are increasing at a rate of 0.2 million m^3 per year. These figures are high because they overlap some earlier growth loss projections and they assume total mean annual increment losses on *all* brushed-in sites although some growth will almost certainly occur where commercial species are established.

Management techniques to minimize brush problems on recently denuded areas include appropriate harvesting systems, immediate site preparation and planting with quality planting stock. Techniques used to treat an area following brush invasion are usually more expensive and involve manual or mechanical clearing, herbicides or prescribed fire before planting.

Insects, Disease and Decay. Losses to insects, disease and decay totalled about 28 million m^3 annually, with over one-third due to bark beetles alone. Clearly, the opportunity exists for improvement in the future.

Control treatments directed specifically against forest pests are aimed mainly at bark beetles. However, control of other forest pests may occur as a secondary effect of intensive silvicultural treatments such as juvenile and sanitation spacing (bark beetles, mistletoe), site rehabilitation (mistletoe, root rot) and knocking down all residual stems 3 m or taller left after logging (mistletoe). Estimates of wood volume saved annually through the various control methods are not currently available.

The Canadian Forestry Service and the Ministry of Forests conduct annual aerial and ground surveys to detect bark beetle infestations and to assess the extent of damage. Control methods include harvesting, felling and burning infested trees, chemical treatments and catching the beetles with trap trees. Target species include mountain pine beetle, spruce beetle and Douglas-fir beetle.

The stand's response is measured by the amount of re-infestation observed during subsequent surveys. Areas infested and treated and survey results are published annually in map form by the Canadian Forestry Service and in the Ministry of Forests' Annual Report.

Mistletoe control measures usually involve eliminating infected residuals through harvesting or felling, bucking and burning. In most forest regions, mistletoe control has been incorporated into other harvesting or silvicultural activities. No formal mistletoe control or treatment response monitoring program exists in the province. Logged or infested areas are inspected to determine the need for treatment but no assessments are made of the potential effect of mistletoe eradication on subsequent tree growth.

Decadence. No surveys have been conducted specifically to determine the extent of decadent or stagnant timber. But, based on inventories and professional judgments, decadent and stagnant stands are estimated at 3.2 million ha and 2.0 million ha, respectively. This amounts in total to about 13% of productive forest lands.

Decadent stands consist of mature timber growing very slowly or reducing in volume due to decay and for which no timber values are expected for the next ten years. Much of this material could be used for pulp, reconstituted board and panel products or energy. Hollow shells of decadent cedar have also been used for sawn specialty products or shakes and shingles. Because harvesting and transportation costs may be higher than those for sound wood and because sawmill residues are high, only the best and most accessible stands are used. Many of these stands occupy productive forest land. A major site rehabilitation program is needed to remove the standing timber in order to reestablish a new forest.

Stagnant stands of extremely dense immature timber usually result from wildfires. They are not expected to become merchantable without major intervention such as juvenile spacing or, in severe cases, total elimination and renewal by planting. No programs are in place to deal specifically with decadent or stagnant sites, although some site rehabilitation treatments are conducted on locally identified areas.

Wildfire. The average volume lost and area denuded by wildfire each year between 1974 and 1983 was approximately 4 million m^3. A ten-year average is used to smooth out the large annual fluctuations resulting from the effects of weather on wildfires. The statistics on the areas burned (a total of 50,000 ha) do not include range lands, not satisfactorily restocked lands, noncommercial brush and nonproductive areas, but they do include all other areas. Figure 6 depicts the proportion of the total volume lost to wildfire in each Ministry of Forests administrative region.

Basic and Intensive Silviculture. To improve the resource's condition, basic and intensive silviculture treatments have been undertaken. As shown in Figure 7, the area planted increased from just over 50,000 ha to almost 95,000 ha between 1979-80 and 1983-84. The number of seedlings planted increased from 58 million to 108 million over that same period. Brushing and weeding more than doubled from 2900 ha in 1979-80 to 7100 ha in 1983-84. Other intensive silvicultural activities decreased as priorities were shifted to meet increasing planting targets.

Figure 6. Average Annual Volume Lost to Wildfire, 1974-1983

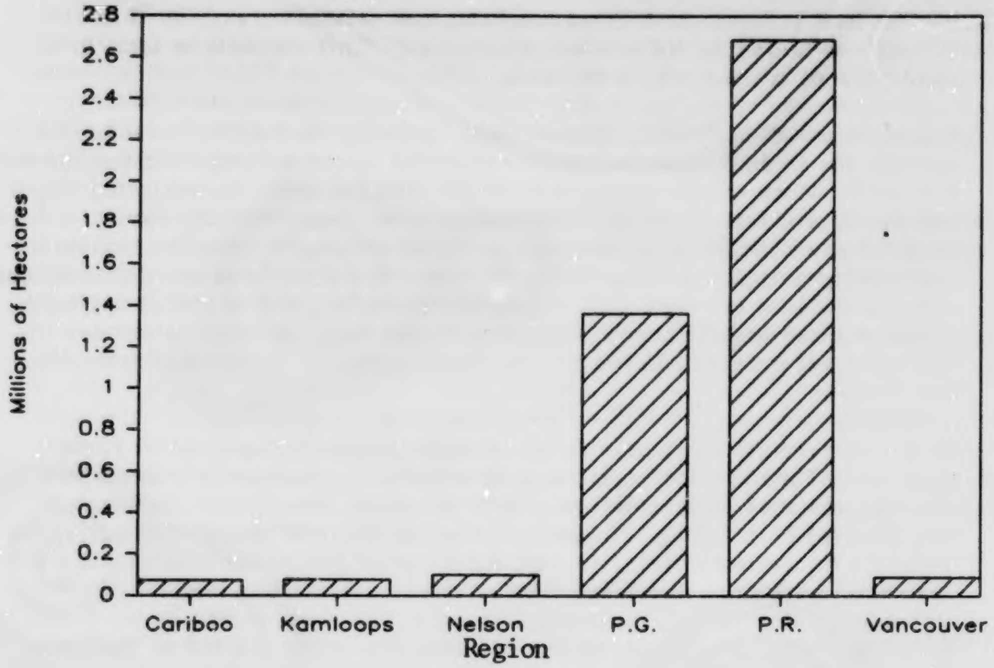
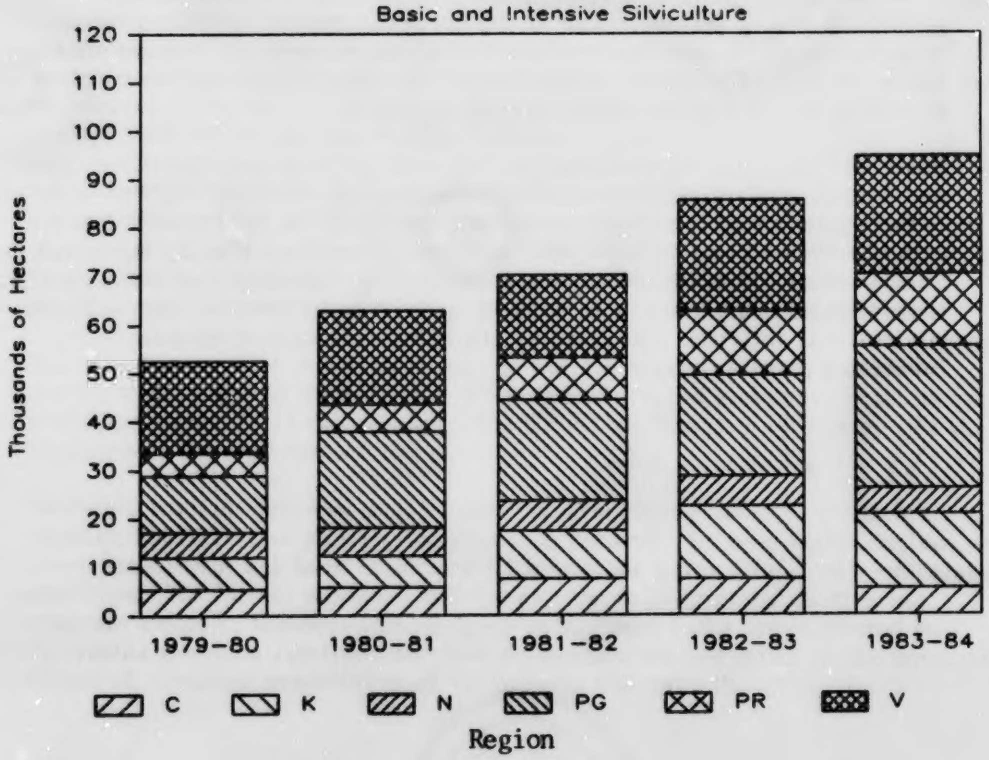


Figure 7. Area of Seedlings Planted on Crown Land



Opportunities exist to further improve the condition of the timber resource through intensive management but actual treatment response data is presently unavailable. The Inventory Branch initiated an intensive forestry monitoring program in 1979 to build a data base for managed stand yield tables. Permanent fixed area sample plots were established in spaced and fertilized stands with control plots located in nearby untreated areas. Remeasurements are to take place at five-year intervals with the first remeasurement due in 1984. Response data will be available when this information has been collected, collated and analyzed.

No operational monitoring systems are currently in place for other intensive management activities such as site rehabilitation, conifer release, sanitation spacing, commercial thinning, seed tree control or brushing and weeding.

The Research Branch maintains several growth and yield research installations on the coast and in the interior to obtain growth response data from intensive silvicultural treatments such as juvenile spacing, fertilization and commercial thinning. While much data is collected from research plots established as early as 1929, it is limited in its application to operational treatments because the research plots are located in carefully selected sites under controlled experimental conditions. What could be expected from less rigorously applied operational treatments under more variable stand conditions remains unclear.

Several of the major forest companies have established operational monitoring systems designed to generate yield estimates from intensive management treatments, notably juvenile spacing and fertilization. But most of these are either research-oriented systems and generate information that is too localized to be widely applicable or were implemented relatively recently and have not yet generated data for general use.

The various licensee monitoring systems have not been fully evaluated for efficiency and reliability or compatability with Ministry of Forests' data.

An analysis undertaken for the Resource Analysis indicates that if logged areas were all left to regenerate on their own, yield at rotation could fall to less than 50 million m^3. If a full-blown intensive silviculture program were undertaken, yield at rotation could go as high as 100 million m^3. At an intermediate level of silviculture, the yield at rotation would be just over 75 million m^3. Response at the present level was not calculated, but it falls below this intermediate option.

Though predictions are not sufficiently precise to generate definitive investment response curves, the cost per m^3 appears relatively constant over a wide range around current program levels. This indicates that cost-effective treatments could be undertaken if they are required to attain regional timber supply goals.

Transportation System. The condition of the transportation system was also examined because of its importance in the effective use of timber supplies. Some problems were identified in each region, but in general the transporation system was better than anticipated. However, road building for timber extraction has been curtailed in recent years, leaving an expensive program to be undertaken in the near future when the industry must reach out to harvest more remote stands.

Economic Profile. Another measure of the condition of the timber resource is its economic profile. At present, logging operations are largely confined to timber with the highest net value and even then, stumpage returns are at minimum rates. This condition is forecast to continue for several more years, even after markets begin to improve.

That the high-value end of the supply is being depleted becomes an inescapable conclusion when the species and locales of present operations are considered. And relaxed utilization standards have aggravated this problem by allowing larger areas to be cut to attain the same timber volume. In effect, the long-established trend to take the best first has been accelerated.

This leaves the lower-quality wood to be harvested when the price of forest products increases or when new technology allows cheaper logging and manufacturing. But whether either condition will materialize is unknown. New technologies such as air-lift systems are being developed, but their ability to harvest marginal stands at a reasonable cost is still unknown. Strategies to make the most of the marginal wood must, therefore, now become an essential part of forest management planning.

Access is one of the main problems to be overcome. Much of the marginal timber is inaccessible from the present road system. Not only have roads not been built into remote areas, but in some areas, first-pass logging has removed the accessible higher-valued timber leaving low-valued stands to underwrite the cost of extending roads or restoring the road system already in place. Furthermore, the recession has curtailed road building to as little as one-third of what is needed to allow rational development of the full supply profile.

Range Resource

Crown range use amounts to 924,122 Animal Unit Months per year. The Cariboo and Kamloops regions, which together have only 42% of the province's utilized rangelands, support 76% of the cattle.

Of the Crown range that is currently utilized, 77% consists of four range types: transitional, lodgepole pine forest, deciduous forest and dry forest. In proportion to the amount available, the most intensive use is being made of open range, clearings and ponderosa pine forest. That does not mean that a large surplus capacity exists in the other types: numerous factors constrain further utilization. The present level is judged to be near maximum unless management efforts are increased and, even then, utilization could be expected to increase in only a few range types.

Given available data, the condition of the range resource cannot be assessed as rigorously as the condition of the timber resource. However, we can identify the major factors affecting range condition, the severity of the problems and what is being done or could be done to alleviate them. The factors include forest encroachment, weed encroachment, livestock-wildlife forage competition, livestock predation, livestock distribution, settlement and other land uses, and an array of other conditions that prevents livestock from using available forage. Among these, knapweed stands out as a serious problem that could affect one-quarter of the province's rangelands unless control programs are expanded.

Forest Encroachment. About 69% of the forage used by livestock is from forested and transitional forest Crown lands. Forest encroachment into these areas and some open grasslands is causing near-ground herbs and shrubs to decline in composition and production. This results in significant reductions in available forage for livestock and wildlife.

More than any other single factor, forest encroachment requires attention to sustain forage production levels needed to meet existing and future livestock demands. Presently, three management prescriptions are used to offset reductions due to forest encroachment: prescribed burning, grass seeding of cutblocks and selective thinning of stagnant forest stands.

In the Peace River area, prescribed burning in transitional stands of deciduous trees has significantly improved wildlife habitat and forage production. Range burning has also been used successfully where dry understory vegetation provides sufficient fuel to burn brushy or otherwise stagnant forest stands.

Stand thinning could also enhance forage production, particularly in stagnant stands of lodgepole pine, yellow pine and Douglas-fir growing on poor sites. But the costs are prohibitively high, ranging from $375 to $450 per hectare.

Seeding cutblocks with highly nutritious domestic forage is relatively inexpensive, costing approximately $4 to $6 per hectare for aerial seed application and $70 to $85 per hectare for site scarification. When properly integrated with silviculture prescriptions, seeding substantially increases the benefits derived from the forest land base since the land supports cattle while the forest is regenerating. Currently, 10% of the forest lands logged annually is seeded to produce forage.

Weed Encroachment. Noxious weeds are a major threat to the condition of the Crown forage base, the most notable being spotted (*Centaurea maculosa*) and diffuse (*C. diffusa*) knapweed. These unpalatable weeds, which are drought and cold tolerant, rapid producers of highly viable seed and free of natural disease and parasitic organisms, are able to out-compete native perennial range vegetation. In fact, wherever these weeds become established, desirable range plants are virtually eliminated.

Knapweed infestation grew rapidly from a few isolated locations in 1930 to 8,000 ha in 1954, to 30,000 ha in 1972, and, according to current estimates, to 84,000 to 95,000 ha in 1984. At this rate, knapweed infestation could reach 300,000 ha by the year 2000. This represents approximately one quarter of all provincial native grasslands. These heavily infested pastures are considered unsalvable. In such areas, losses in forage production are frequently up to 95% of potential.

In an effort to retard the knapweed expansion, several provincial agencies and private interest groups began a chemical containment program in 1969. The principal objective of this program was to contain the rate of spread by spraying areas where new infestations are reported. The short-term benefits of the chemical containment program began to be realized in the late 1970's and early 1980's during which time annual funding grew gradually to $1 million (1982). At this level, the spread of knapweed into new areas of the Cariboo, Kamloops and Nelson Forest Regions was substantially curtailed. However, in the Boundary and Okanagan areas, where no containment program was initiated, knapweed infestations continued to increase dramatically both in number of sites and in density.

The most promising long-term solution to the knapweed problem is biological control. Numerous cooperative research activities in this area have been initiated in recent years. Their objective is to identify parasitic and predatory organisms that weaken the competitive advantage of knapweed over native range plants. Presently, six organisms including weevils such as *Cleonus piger*, root boring moths (*Pterolonche inspera*) and knapweed rust (*Puccinia spp.*) have been introduced into knapweed areas at various locations throughout the province. However, incomplete distribution, poor survival and insufficient impact have limited their effectiveness.

Substantial increases in research efforts, manpower and funding in the area of biological control is required in the near future if positive results are to be expected within the time framework required to prevent knapweed from devastating provincial rangelands.

Concern over the knapweed problem coupled with the need to evaluate the effectiveness of the chemical containment program led to the recent establishment of a computer file system designed to store information pertaining to site-specific containment activities. This represents a significant first step in developing a monitoring program that will document existing areas of knapweed infestation, new areas of infestation, rates of expansion and other information vital to the fight against knapweed.

Currently, only the areas covered under the containment program are monitored. If knapweed is to be contained successfully, the monitoring program must be extended to include areas where containment is not presently practised and where biological agents have been released. The monitoring procedures also need to be refined to ensure that the parameters critical to knapweed's cost-effective management are adequately assessed.

Livestock-Wildlife Forage Competition. Continued alienation of lands capable of providing forage for livestock and wildlife led to significant competition between domestic stock and wildlife for available forage. Most notable is the competition in the southern Rocky Mountain Trench area of the Nelson Forest Region where elk numbers increased dramatically from an estimated 8,000 animals in 1975 to as many as 18,000 - 20,000 today. This dramatic increase, combined with the livestock forage demand and diet similarities, created significant pressures on the forage base. This problem has been exacerbated by forest encroachment which forced elk to concentrate on lower ranges traditionally used as spring and fall range for livestock.

If increases in elk populations continue unchecked, considerable damage to the Crown forage base is inevitable and will result in undesirable socio-economic conditions for many residents of the southern Trench. In other areas, competition between wildlife populations and livestock is not as significant. However, such actions as the recent introduction of elk into the west central Cariboo underline the need for a comprehensive strategy for forage allocation to livestock and wildlife. This would help resolve current livestock-wildlife conflicts and prevent their recurrence in the future.

Livestock Predation. Livestock predator problems are inevitable wherever wildlife and livestock occur on common ranges. Predation is most noticeable in range units that adjoin remote, unsettled or sparsely settled areas.

Livestock predation losses result not only from deaths but also from weight loss and reduced weight gain rates due to stress induced by predator activities. The latter have not been monitored so their extent and severity remain uncertain but these indirect losses could be significant. Livestock predator problems appear to occur in cycles, peaking when wild ungulate numbers are reduced and predator numbers are relatively high. Data to substantiate this observation are unavailable.

Livestock Distribution. Livestock distribution depends on a number of natural and artificial features and animal behavioural characteristics.

Cattle tend to congregate in traditional grazing areas to which they have been repeatedly exposed, and in areas where highly preferred forages dominate the vegetation. They also tend to move along traditional corridors and along routes that provide easy access to forage.

Cattle tend to select more open areas even if they contain less forage. Livestock also tend to favour flatlands and areas of shallow slope. They are also attracted to areas where management prescriptions such as burning, fertilization and grass seeding have enhanced the forage nutrient status and production.

Successful grazing management requires that the factors that influence cattle distribution be understood and that proper corrective measures be taken. The placement of salt blocks and water away from areas where cattle congregate, combined with strategically located fences and the use of appropriately designed grazing systems help to distribute livestock and thus prevent damage to the forage base.

Settlement and Other Land Uses. Expanding urban areas are responsible for alienating some of the most valuable spring and fall Crown ranges, since both towns and ranges tend to be located in river valleys. In addition, pets, other livestock and vehicles, all of which are associated with settlement, disturb grazing livestock and urban settlement sometimes blocks water supplies and cattle trails. Expanding agricultural uses are also responsible for alienating valuable spring and fall ranges.

Other Limiting Factors. Several factors restrict livestock from harvesting available forage. These include topography, unsuitable habitat, access limitation, water limitation, boundary control, water control, and soil moisture and nutrients.

Topography can restrict livestock from reaching some forage on benches and other inaccessible areas. However, as many of these areas may be suitable for wildlife, the provision of access may lead to conflicts.

Unsuitable habitat refers to forested range that has adequate forage but where livestock distribution is difficult to achieve because of predators, distance from the base ranch and other factors.

Access limitations may be overcome with trail developments; water limitations with water developments; and boundary control with fencing developments. A large portion of ARDSA expenditures and Ministry of Forests expenditures has been directed toward these problems.

Water control in some wetland sites is a continuing problem. Some drainage and irrigation projects have been undertaken in cooperation with Ducks Unlimited, individual ranchers and other government ministries.

Soil moisture and nutrient status can be treated through irrigation and fertilization, but this type of intensive management has rarely been attempted on Crown range. Some Community Pasture Associations have occasionally used fertilizer.

Recreation Resource

Annual recreational use of forest and range lands amounts to about 13 million user days. Of these 1.7 million were accommodated by Ministry of Forests' recreational sites and another 300,000 by trails managed by the ministry.

The values that support outdoor recreation can be adequately protected through multiple use planning. Nonetheless, the condition of recreational facilities is declining; at the same time demand is increasing.

The 1979 Resource Analysis projected that by 1985, use of Forest Service facilities would be what it is today: 2 million user days. It also projected that the capacity would be increased to 13,000 vehicle units, but it is currently only 9,125.

SECTION 2

Present Resource Management Policies and Programs

The ministry organizes its activities under nine programs. The main report describes the purposes of each program, major accomplishments since 1979, and significant trends and issues that will affect future developments. In this section, a brief overview of each program and a synopsis of some of the more important issues are provided.

The Ministry of Forests' programs are driven by the ministry's goals and objectives, which are based in part on the following precepts:

1. **Sustained Yield**: The timber resource will be harvested on a sustained yield basis. In practice, sustained yield management must allow for a declining harvest during transition from harvesting primarily mature timber to harvesting primarily second growth.

2. **Conservation of Grazing Land**: Grazing will be regulated so that range quality and ecological integrity are maintained.

3. **Recognition of Aesthetic Values**: Aesthetic values of the forest resources will be recognized and public right of access to enjoy them will be ensured.

4. **Integrated Management**: Timber harvests will be integrated with protection and management of other resources to achieve the greatest benefits from all resources.

5. **Community and Employment Stability**: Decisions about the timber resource use will consider community and employment stability.

6. **Security of Supplies**: Rights to harvest timber and to use range land will be granted under tenure provisions that allow the industries sufficient security of supply to make long-term investments in infrastructure, resource improvements, equipment, manufacturing facilities and stock.

7. **Fair Price for Crown Resources**: Timber and grazing rights will be priced so that the Crown receives fair market value for its resources.

8. **Efficient Development of Management Units**: Management unit planning and development will recognize short- and long-term needs of the forest industry and communities.

9. **Harvesting Practices**: Harvesting practices will be determined not only by the need to remove timber efficiently, but also by the needs of other resource users, by the requirements of site protection and by the need to reestablish suitable forest cover.

10. **User Participation:** Insofar as it is consistent with the ministry's overriding mandate to protect the Crown's interest in timber and range resources, management decisions will be made as close as possible to the operational level to ensure that the needs of the forest and ranching industries and other resource users are considered. Similarly, management responsibility will be delegated to the forest industry to the greatest possible extent to capitalize on professional capabilities and management skills.

Management Program

The Management Program provides executive direction and control to the whole ministry and spans the three organizational levels: at headquarters in Victoria, it includes the activities and expenditures of the Executive of the Ministry, Information Services Branch and Strategic Studies Branch; at the regional level, it includes the regional manager and regional staff managers; and at the district level, it includes the district managers, operations superintendents and support services supervisors.

Wages and salaries account for about 85% of this program's expenditures; materials, expenses and supplies account for the remaining 15%. The program accounts for about 4% of the ministry's expenditures.

Finance and Administration Program

The Finance and Administration Program provides the infrastructure for the whole ministry. At headquarters in Victoria, the program includes the activities and expenditures of Financial Services, Personnel Services, System Services, and Technical and Administrative Services Branches; at the regional level, it includes administrative, personnel, training and technical support officers; and at the district level, it includes clerks, draftsmen and service technicians.

The major expenditures are for wages and salaries, and for buildings, grounds and offices, which the ministry rents from the British Columbia Buildings Corporation. Payments to the corporation account for about 35% of total expenditures. Wages and salaries make up an additional 40%. The program accounts for about 20% of the ministry's expenditures.

Research Program

The Research Program conducts scientific investigations to provide information needed to achieve the objectives of the forest and range resource management programs. It includes the activities of the Research Branch at headquarters and research officers at the regional level. It accounts for 3% of the ministry's expenditures.

Range Management Program

The Range Management Program makes grazing land available for domestic animals while conserving the resource base so that future forage production will continue in a manner consistent with multiple-use objectives for Crown land.

The program includes the activities and expenditures of the Range Management Branch at headquarters, range officers at the regional level, and range resource officers at the district level. It accounts for 2% of the ministry's expenditures.

Recreation Management Program

The Recreation Management Program endeavours to maintain and enhance recreational values and to provide a system of sites and trails to facilitate public recreational use of Crown forest land consistent with the ministry's multiple-use objectives.

The program includes activities and expenditures of the Recreation Management Branch at headquarters, recreation officers at the regional level and recreation resource officers at the district level. It accounts for 1% of the ministry's expenditures.

Harvesting Program

The Harvesting Program makes timber available to the forest industry in a manner that reflects provincial forest resource objectives and ensures that the financial interests of the Crown are realized.

At Victoria, the program includes the activities and expenditures of Valuation, Timber Management, Engineering, and Planning and Inventory Branches. At the regional level, it includes harvest planning and coordination personnel; and at the district level, it includes timber, scaling, engineering and inventory resource officers.

The major expenditures are for salaries and for forest management activities paid for through Section 88 of the *Forest Act*. The program currently amounts to 24% of the ministry's expenditures although it normally accounts for almost double that figure.

Forest Protection Program

The Forest Protection Program protects the provincial forest and range resources from damage by wildfire, insects, diseases and other pests. It includes the activities and expenditures of the Protection Branch at headquarters, protection officers at the regional level, and protection resource officers at the district level. This program currently accounts for 5% of the ministry's expenditures.

Fire Suppression Program

The Fire Suppression Program provides fire-fighting services for controlling wildfires. It is linked closely to, and supported by, the Forest Protection Program but is managed and funded separately. Actual expenditures vary with the severity of the fire season but the budget is currently estimated at 9% of the ministry's total expenditures.

Silviculture Program

The Silviculture Program restocks denuded forest land and improves the value and productivity of the forest resource.

The program includes the activities and expenditures of the Silviculture Branch at headquarters, the silviculture officers at the regional level, silviculture resource officers at the district level, and nurseries and seed orchards located throughout the province.

The major expenditures under this program are for approved silvicultural treatments or activities undertaken by licensees and financed through Section 88; and by contractors, financed through budgetary allocations. This program accounts for 32% of the ministry's expenditures.

EXPENDITURES

Program expenditures by the Ministry of Forests averaged almost $324 million per year (1984$) between 1979 and 1984.

Except for Finance and Administration, Harvesting, and Silviculture, the programs maintained the same proportion of the ministry's total expenditures during this period. The relative expenditures of the Finance and Administration program increased from 16% of the ministry's total expenditures in 1980-81 to 20% in 1983-84. Similarly, relative expenditures of the Silviculture Program increased from 27% to 32%. But the Harvesting Program's relative expenditures fell dramatically from 38% in 1980-81 to 24% in 1983-84.

These figures reflect the impact of the recession on the forest industry. Because the industry was functioning at such low profitability, harvesting expenditures particularly on road building were reduced to an absolute minimum. This leaves a backlog to be overcome in the near future. The silviculture expenditures were kept as high as possible, primarily in the area of planting, by shifting priority from other programs.

ISSUES

Research Program

1. Contract research is suitable for relatively short-term, well-defined projects in which results become available relatively quickly (within 5 years). It is a particularly effective way to acquire expertise unavailable on staff. Experience, however, shows that the contract approach in long-term projects, such as tree breeding or intensive silvicultural practices, lacks the continuity of personnel critical to successful research. It is, therefore, essential that contracts are used as part of, rather than a replacement for, research capabilities within the ministry.

2. While serious attempts are made to determine the most cost-effective silvicultural prescriptions from a timber management point of view, little attempt is made to identify or quantify their impacts on nontimber values such as recreation, wildlife and water quality. Attaining well-balanced decisions that optimize resource values will require more research attention to all forest resources.

Range Management Program

1. The knapweed containment program in Kamloops and Nelson Forest Regions must be expanded to prevent continuing degradation of open rangelends.

2. **Quantitative planning has been almost totally oriented toward forestry uses of the land base. To ensure that forage and other resource uses are considered, range unit planning must be improved and research on tree-forage-livestock interactions undertaken.**

3. **Grass seeding of clearcuts is one of the most cost-effective ways of achieving the Ministry of Forests' range goals. The program to seed appropriate clearcuts in areas adjacent to ranches requires continued support.**

4. **The appropriate allocation of range resources between livestock and wildlife is a major issue in some parts of the province (e.g. in the East Kootenay portion of the Nelson Forest Region and in the Cariboo). Further research on wildlife and livestock forage, nutrient and habitat requirements should be undertaken so that forage can be allocated appropriately.**

Recreation Management Program

1. **The Ministry of Forests' mandate and the mandates of other ministries regarding outdoor recreation are ambiguous. This has resulted in overlapping or inadequate programs and in misunderstandings regarding the role of the recreation program in integrated management. Interministerial protocol agreements, developed to coordinate activities, have had limited success. And the Outdoor Recreation Coordinating Committee is dormant.**

2. **In-service landscape expertise is lacking and needs to be redressed. This capability is needed to protect scenically sensitive areas important to public enjoyment and to anticipate and mitigate the adverse visual impacts of proposed logging activity.**

3. **Site and trail development has been kept at a maintenance level for the past two years. As a result, instead of keeping up with the growth in demand or fulfilling the originally approved program goals, the quality and quantity of sites and trails have decreased and all facilities have deteriorated.**

Harvesting Program

1. **Regional goals must be established to set priorities between and within TSAs and TFLs and to resolve incompatibilities with other agencies' programs. Planning models that consider the yields and values of other resources such as fish, wildlife, recreation and visual quality could help improve coordination between the Ministry of Forests and other ministries.**

2. TSAs frequently extend beyond district boundaries, which complicates planning and management. Where possible, boundaries should be changed so that each district contains a single TSA. Some TFLs also extend beyond district boundaries. Where possible, district boundaries should be changed so that the entire TFL can be administered by one district manager.

3. TSA plans and TFL management and working plans are currently incompatible with the ministry's Five-Year Program. Further development and use of computer systems might help integrate ministry program and plan development.

4. Road construction for timber harvesting requires legal, unhindered access through any alienated lands (e.g., private properties, leased lands, Indian Reserves) and over such areas as mineral claims, railway crossings, gas and oil pipelines. During the past five years, a backlog of several hundred access roads has accumulated for which rights-of-way have not been acquired. To alleviate this situation, rights-of-way must be acquired before construction begins.

5. To maintain adequate records of land status and timber tenures, a unified resource mapping system needs to be adopted to cover base maps, cadastral surveys and forest cover. At present, legal descriptions are frequently incompatible with forest cover maps. An interagency committee headed by Technical and Administrative Services Branch is working to resolve these differences.

6. There are a number of issues related to appraisal policy, including how much to charge for Crown timber and how to minimize administrative costs in timber appraisals. Other appraisal-related matters include--

   - incentives for utilizing low-value decadent stands and species,

   - degree of compatibility between resource management objectives and appraisal policy,

   - greater reliance on private industry to determine quantity, quality and value of harvested Crown timber,

   - redefining criteria for Section 88 projects,

   - improvements for processing scale and royalty invoices.

7. The recent recession has placed the stumpage level at minimum in most areas, making it impossible for some licensees to offset all credits earned under Section 88 against stumpage payments. Because of this, the budget for the Section 88 program was reduced to $59 million for 1983-84 from $89.8 million in 1982-83. Consequently, funds are insufficient to support the basic silvicultural program and logging road construction.

8. The provisions for export of unmanufactured logs remain contentious as many people equate it with a loss of domestic jobs. Because of the concern over the increased levels of log export, the government appointed a Log Export Advisory Committee in 1983 to review provincial policies and procedures. Their recommendations include a revised fee in lieu of manufacture for coastal timber based on log quality and grade. Subsequently, rules governing export of logs were revised to more explicitly define the categories of timber that will qualify.

Forest Protection and Fire Suppression Programs

1. Protection priorities and target levels need to be developed for each timber supply area and each tree farm licence. In addition, a more sophisticated method is needed to determine the impact of fire and pest losses over a forest rotation and the effects of such losses on allowable annual cuts. Such improvements will reduce the number of managed units being overprotected at the expense of those being underprotected.

2. High wages and the high cost of equipment, machines and aircraft have all made forest protection a high-cost business. To cope with these increasing expenditures, each cost-generating activity must be made more cost effective. In *pest* management, greater cost effectiveness could be achieved by developing an historical data base for the major pests along with models that protray their predicted impact with and without treatments. In *fire* management, greater cost effectiveness could be achieved by--

    - increased emphasis on developing computer models that will improve decision making (e.g. developing fire behaviour models, fire occurrence prediction models, fire-fighting resource-allocation models and aircraft productivity models);

    - establishing priorities among resources and improvements at risk; and

    - understanding the effects of prescribed fire on ecosystems.

3. The salvage of fire-killed and pest-killed timber needs to be given a greater emphasis than it receives now.

4. The Protection Program's effectiveness is judged on its performance in protecting forest and range resources. But demands to protect life, property, animal habitat, domestic watersheds, transportation facilities and recreation areas are increasing dramatically as housing developments continue to press further into rural and forested regions. Policies are needed on how funds are to be allocated among these diverse objectives.

5. Presuppression activities such as fire prevention, detection and initial attack have been reduced. The results of this policy must be monitored carefully to ensure that we do not incur larger fires with attendant higher costs and damages.

6. Fires started by arsonists have reached alarming proportions in the Cariboo Forest Region and have increased significantly in the Prince George and Prince Rupert Regions. In the Cariboo, such fires have increased by 50% in the last five years and account for about 23% of all fires. In addition, extensive areas of dead and dying forests caused by bark beetle epidemics have set the stage for catastrophic fires which could threaten the safety of rural residents.

7. The largest pest problem in the province is the massive and escalating bark beetle infestation, which is killing pine and spruce stands in five of the six forest regions. The area under attack has grown from 32,000 ha in 1975 to 540,000 ha in 1984. Some 59 million m^3 of merchantable timber have been killed during this period. No natural population collapse is expected until the majority of susceptible pine and spruce stands have either been destroyed by the beetle or logged. Forests at risk to further attack amount to 1.1 billion m^3 of timber.

8. The use of pesticides in forestry remains controversial. Herbicides are needed in some areas to clear out brush before tree planting operations and during the stand-establishment and tending phases to protect the new forest from competition and crowding out.

9. Forest management is being severely inhibited because the information on forest insects and diseases is insufficient to meet the complex requirements of today's resource managers; and the data being collected now will not satisfy future needs. Until an information base has been compiled on each important host-pest complex, acceptable prevention and control options will be both difficult and inconsistent.

10. Cost-effective solutions to many pest outbreaks lie in early detection and in the ability to initiate rapid and aggressive action before the problem escalates beyond control. But the present budgeting system does not permit such emergency action: time-consuming proposals must be made to various levels of government, which prohibits quick and economical solutions. Provisions for drawing on emergency funds would enable the Protection Program to cope with pest outbreaks before they get out of hand.

Silviculture Program

1. Site preparation, brushing, weeding and present planting levels are all insufficient to sustain current levels of allowable annual cut. It is estimated that 160 million seedlings need to be planted annually.

2. A total of 2.9 million ha of productive forest lands (good and medium sites) are partially or completely occupied by brush. This area is expected to increase by 48,000 ha per annum unless treatments are undertaken to ensure that free-growing plantations are established. In the interior, much more attention must be given to mechanical site preparation as well as to 'brown and burn' techniques to achieve site preparation objectives.

3. Nursery production is insufficient to meet sowing requests which far exceed program goals. This is a particularly severe problem in the Cariboo Region where licensees have been directed to harvest beetle-killed timber, thus increasing the denudation rate.

4. A changeover from bareroot nursery systems to container production must be accelerated. This will provide more uniform stock, meet production goals, reduce costs of nursery production and planting, improve field survival rates and plantation growth performance, and eliminate frost-heaving losses. The changeover is particularly important to the interior spruce nursery program where research has shown that significant improvements can be made in plantation growth, survival and seedling physiology when container seedlings rather than bareroot seedlings are used.

5. Cold storage facilities (public and private) for seedlings in north-central B.C. are inadequate. Facilities for an additional 10 million seedlings are needed over the next four years. Otherwise, the equivalent amount of stock must be planted without cold storage in the summer or early fall, when the planting logistics are more difficult.

INTEGRATED RESOURCE MANAGEMENT AND ENVIRONMENTAL PROTECTION

This part of the Resource Analysis examines the integration of the Ministry of Forests' programs with those of other agencies. The major issues in integrated use relate to the clarity of resource use objectives, provisions for environmental protection and land reallocation, choice of silvicultural systems, rate of timber harvest and administration of Provincial Forests.

Integrated Resource Use Objectives

Conflicts about how land will be used are resolved by negotiation among resource management agencies. While administratively cumbersome, this process has allowed reasonably effective plans to be prepared for most areas. But increasing demands for resources threaten to burden the managers with escalating unresolved controversies.

Contentious decisions and unresolved issues arising from negotiations are currently arbitrated by government. In these cases, the planning processes generate options that are usually based on local objectives. When these plans are subsequently directed to higher levels of decision-making, they are viewed in terms of broader social and economic objectives. Consequently, all of the options might be unacceptable. Such cases tend to undermine the image of government and resource agencies and to discredit further attempts to generate optimal resource plans. The solution is to develop more clearly enunciated resource allocation policies.

Environmental Protection

Protecting the environment is an important responsibility of integrated use management. But experience has shown that the current project-oriented impact studies may not provide adequate protection. Therefore, project screening, public participation and community impact assessments must be integrated with overall resource management planning. Only in this way can the best balance between development and protection objectives be achieved.

Land Reallocation Provisions

The government issues long-term tenures to the forest industry to provide them with secure timber supplies. But it can still reallocate tenured lands to other higher uses and socially desirable purposes under the withdrawal provision of Section 53 of the *Forest Act*. However, when compensation is required, it can be so costly that it becomes impractical to remove the land from the tenure. Evergreen provisions, though, allow the conditions of these long-term timber tenures to be renegotiated at specified renewal dates.

The short-term forest tenures have no renewal provisions, so the Crown can review the prudence of these grants when the tenure expires and, where advisable, reallocate lands to meet current needs.

Choice of Silvicultural System

The silvicultural system used has a major impact on the ability of forest lands to support integrated use. In British Columbia, the most frequently used silvicultural system is clearcutting. This is primarily due to the biological requirements of the tree species, as well as harvesting technology and economics. Clearcutting is also indicated when disease, insects or unmerchantable volumes prevail, and is frequently needed to sanitize an area and to reduce fire hazard.

On biologically sensitive sites or on sites having high recreational or aesthetic values, however, clearcutting may be inappropriate or unacceptable. Group selection, strip selection and shelterwood systems may be preferred alternatives to clearcutting in some areas.

Currently, the trend is to make site-specific preharvesting prescriptions within ecological guidelines, but clearcutting to promote even-aged forests of fast-growing, intolerant pioneer species will likely continue to be the dominant silvicultural system under most conditions. Prescribed fire will also remain a major treatment for consuming slash, controlling insects, disease and brush, and preparing seedbeds or planting spots. Pesticides, as well, need to be used sometimes as part of the overall silvicultural system, particularly on coastal sites.

Rate and Distribution of Timber Harvest

Timber management decisions regarding the spatial distribution and rate at which logging will proceed within localized areas (such as individual watersheds) perhaps have the greatest impact on integrated use objectives. These considerations are significant when there are concerns about wildlife habitat, aesthetics, long-term timber supply management, forest protection, silviculture, water supplies or fish habitat. These concerns must be identified during watershed planning and an appropriate rate of cut determined before any logging begins.

Administration of Provincial Forests

The program of establishing Provincial Forests is nearing completion with 134 designated and 5 proposals awaiting final approval. Provincial Forests presently cover over 70 million ha, or approximately 74% of the province's land base, with further additions expected in the near future.

An important outcome of the program will be a greater predictability and stability of timber supply to an industry long plagued by erratic land allocation decisions. The security afforded by Provincial Forest status will not only protect existing investments but should also create an incentive to make further investments in intensive silviculture, reforestation and improved manufacturing facilities.

A set of agreements and protocols was developed to clarify the respective roles of ministries in Provincial Forests and to specify procedures for dealing with interagency interests. But these agreements do not cover Provincial Forest lands *within tree farm licences*. Other agencies have expressed some concerns over the administration of nonforest uses within tree farm licences, especially now that this form of tenure is becoming more prevalent. These concerns may be addressed in a new subsidiary agreement being developed to set out management guidelines for these areas.

Under the periodic Provincial Forest Review Process, land withdrawals will be permitted if the social and economic benefits of the alternate use outweigh its impacts on forest, range and recreational values.

SECTION 3

Trends and Opportunities For the Future

This section describes the current status of the forest and ranching industries and examines trends and opportunities affecting their future.

The Ranching Industry

The beef industry is a major economic and social force in British Columbia. In 1981, the total capital value of all farm holdings including lands, buildings and livestock was estimated at roughly $8.5 billion, close to 75% more than the 1971 figure of $4.9 billion (1981$). In terms of farm cash receipts, the beef industry accounts for 11 to 14% of the agricultural industry, putting it in third place behind the dairy industry and the poultry and egg industry. In 1983 the cash receipts from cattle operations were nearly $113.8 million, compared to $839.5 million for agriculture as a whole (both figures in 1981 dollars).

Between 1971 and 1981, beef production grew 25% while, in the rest of Canada, production declined by 3%. British Columbia's better-than-average performance can be attributed to three factors. First, the rangelands do not lend themselves to alternative uses. Therefore, a rancher, unlike most of his counterparts in other provinces, cannot shift out of cattle production into some other type of agriculture. Second, the typical British Columbian rancher carries on regardless of the prevailing economic conditions. Third, the Farm Income Insurance Program helps ranchers weather hard economic times. However, in spite of its impressive growth, the cattle industry produces only about 7% of Canada's beef cattle.

In the record production year of 1981, the beef cow herd numbered 234,000 animals; and the total number of beef cattle in the province, including calves, heifers (one-year-old females) and steers (one-year-old males), came to more than 700,000 head.

In response to increased cattle production, forage production also increased. The total area in hay production in 1981 was 290,000 ha, an increase of 82,000 ha over the 1971 figure of 208,000 ha. Over the same ten-year period, the area of corn silage production increased from 5,000 ha to 12,000 ha; improved pasture, from 161,000 ha to 267,000 ha; and irrigated land, from 89,000 ha to 100,000 ha. During the same period, the total amount of private farmland fell by 185,000 ha, from 2.2 million to 2 million.

Over 25% of British Columbia's cattle are produced in the northeast; the Kamloops area produces 24%; the Cariboo, 21% and the Okanagan, 15%. The breeding herd is concentrated in the Kamloops and Cariboo regions.

Over the next five years, the ranching industry will experience modest increases in beef production as a result of expansion of the cow-calf breeding herd, increases in backgrounding operations, and improvements in livestock and range management practices.

The Forest Industry

British Columbia's economy has been heavily influenced by the growth of its most important sector, the forest products industry. Growth to its present size and importance has been based on its ability to supply foreign markets reliably with competitively priced, quality forest products. The following discusses the significance of the industry to the provincial economy, describes its major sectors and provides details about its markets.

The forest products group, consisting of wood industries and paper and allied industries, normally accounts for approximately 50% of the total value of shipments by manufacturing industries. The next most important group, the food and beverage industry, usually accounts for only 15%.

The value of shipments by the forest products group declined from $7.6 billion in 1980 to $6.3 billion in 1982, 41% of all manufacturing shipments. In 1983, shipments totalled $7.6 billion, 45% of all manufacturing shipments. This illustrates the cyclical nature of forest products markets.

The forest products industry generally provides direct employment for about 95,000 persons, which represents approximately 8% of total provincial employment. The actual level of employment in the industry, however, varies significantly over the economic cycle. Direct forest industry employment declined to approximately 76,000 persons at the depth of the recession in 1982. Recently there has been increasing automation in the milling sector so employment levels are unlikely to return to the pre-1981 level.

The indirect employment created in sectors of the economy that supply goods and services to the forest products industry and its employees substantially exceeds the number of workers employed directly in the industry. In total, the forest products industry is estimated to provide employment for over 20% of the provincial labour force.

The forest products industry is heavily export oriented and is an important source of foreign exchange earnings for both British Columbia and Canada. It normally accounts for approximately 60% of the value of British Columbia's foreign exports. Even in the recession year of 1982, exports totalled $4.6 billion, which exceeded the value of mineral export products, the second most important group, by almost $1.9 billion.

The forest industry and its employees are an extremely important source of revenue for the provincial and federal governments. In 1981-82, the latest year for which complete statistics are available, the forest sector contributed an estimated $557 million to gross provincial government revenue. This represented approximately 10% of the total revenue of $5,551 million collected by the provincial government in 1981-82.

The cyclical nature of forest products markets significantly affects how much the forest sector contributes to provincial government revenue through stumpage and corporate income tax. Its contribution ranged from a high of 21% in 1979-80 to a low of 10% in 1981-82.

With the forest industry being so important to the provincial economy, its future is of intense interest. The Resource Analysis attempts to identify the most important challenges and opportunities facing the industry and to indicate areas where government policies might be modified to enable continued viability and world competitiveness. It considers the market trends for the province's major products and reaches the following conclusions.

World demand for forest products is forecast to increase to the year 2000, albeit at a slower rate than recorded in the 1960's and early 1970's. Real price increases will be curtailed by the slower growth, which will pressure high-cost producers to phase out noncompetitive capacity.

The ability of British Columbia's forest products industry to capitalize on the opportunities that arise from the growth in world demand will be affected by resource constraints and the industry's international competitive position.

In the past, the industry's growth has been propelled by increasing the harvest of the high-quality, old-growth timber. During the 1970's, most of this increase occurred in the interior where the harvest grew from 25.9 million m^3 in 1970 to 45.6 million m^3 in 1979 and lumber production more than doubled to 8.9 billion fbm. The expansion in the sawmill sector also created an abundant supply of residual wood chips which provided the interior pulp and paper mills with an economical source of wood fibre.

The growth pattern of the past cannot be expected to continue since the physical limits of the economically harvestable stock of old-growth timber are now in sight. Increased harvests would also incur heavy costs in future wood supply deficits. Consequently, future growth in British Columbia's forest products industry will have to come increasingly from adding value to the products manufactured rather than increasing the volumes produced.

The mature forest to be harvested over the next four to five decades is less valuable than that harvested in the past. If the current rate of harvest of approximately 75 million m^3 per year is to be maintained in British Columbia, less desirable species will have to be harvested in larger volumes and logs will generally be smaller and of poorer quality. Other things being equal, the move into poorer quality and more remote timber can be expected to lead to increasing delivered wood costs, which are a major item in manufacturing costs.

The adverse effect of rising wood costs on the industry's competitive position is already apparent on the coast: sawmills continued to take downtime in 1983 and 1984 despite the recovery in the United States housing market. Control of logging costs, especially on the coast, is crucial if British Columbia's competitive position is to be maintained or improved.

To provide additional perspectives on the future of the forest industry, reports were commissioned from experienced forest consultants. A report by the Sterling Wood Group analyzes the wood cost and other problems facing the coastal segment of the forest products industry and its prospects for the future. This report concludes that some further contraction of the coast industry is probable unless external factors, such as exchange rates, change in the industry's favour. The restructuring is expected to be confined to the lumber and plywood sectors, but the marginal, higher-cost pulp mills could also be affected since the cost of wood fibre will increase as the supply of residual woodchips is reduced by sawmill and plywood mill closure.

British Columbia is not alone in facing wood supply constraints. Other areas such as the United States Pacific Northwest and Scandinavia are facing similar problems. Barring a change in national forest policy in the United States, the harvest in the Douglas Fir Region of the Pacific Northwest is forecast to decline over the next two decades; harvest levels in Finland and Sweden are constrained by their forests' annual increments.

But increased timber harvests from plantation developments in countries like New Zealand and Chile are viewed by many as a competitive threat to British Columbia's forest products industry. A report by F.L.C. Reed, however, concludes that the prospects for increased softwood harvests in different areas of the world will not swamp British Columbia's markets for either lumber or fibre products in the long term. In fact, diminishing world-wide availability of prime sawlogs should cause British Columbia's resource to increase in value. It should therefore be managed more intensively with a confident eye to the future.

Despite sawlog supply constraints, British Columbia has adequate supplies of wood fibre to support additional pulp capacity in at least two areas of the province, the northeast and the southeast. In the northeast, expansion would depend largely on harvesting the presently unused aspen resource. In the southeast, wood fibre for expansion could be derived from three sources: the present surplus of residual woodchips, the logging residuals presently left in the woods, and the whole log chipping of currently unused low-quality wood. Fibre availability in the southeast is analyzed in the Ministry of Forests' report, *Southeast British Columbia - Fibre Resource Study*. Proposals for pulpwood agreements covering these two areas are presently being considered.

While construction lumber, market kraft pulp and standard grade newsprint will undoubtedly continue to dominate the output of British Columbia's forest products industry, opportunities for increasing product values exist in both the lumber and pulp and paper sectors.

Efforts to enhance product values are especially important in the coastal sector of the industry where increasing wood costs have contributed to the erosion of its competitive position in products like construction lumber and market kraft pulp.

A report by Woodbridge, Reed and Associates discusses the current state of secondary manufacturing in solid wood products and the prospects for future expansion. The report concludes that significant opportunities exist to obtain greater value from British Columbia's forest resource, especially hemlock and lodgepole pine, through additional manufacturing at sawmills or remanufacturers or some combination of both. It estimates that this could add approximately $200 million to the value of approximately 1.4 billion fbm of construction grade lumber. This product upgrading would also have the beneficial side effect of removing a significant volume of dimension lumber from the North American market where prices have been depressed due to oversupply.

A second report by Woodbridge, Reed and Associates evaluates the potential for expanding British Columbia's production of higher-valued paper and paperboard products. The report finds that the potential is the highest for lightweight coated papers and supercalendered offset papers. These products are natural extensions of newsprint production and build on British Columbia's strong international competitive position in electric power.

In summary, though the wood supply situation in British Columbia effectively rules out industrial expansion based on increasing harvests, opportunities for growth still exist. But these opportunities involve increasing product value rather than physical output.

British Columbia's mature forest still represents a valuable resource by world standards, but the forest products industry must adapt to ensure that this potential is realized. This will require new technologies, attitudes and marketing skills. In this changing environment, mills that fail to adapt will undoubtedly fall by the wayside.

The increasing cost of logging the remaining mature timber stock has been identified as being extremely important to the future of the forest industry and to future government revenues. It is evident from an analysis of wood supplies in four TSAs that a large proportion of the wood supply is inoperable economically under 1984 market conditions. Costs are likely to increase as marginal wood on steeper slopes becomes available only by high lead yarding methods. As the minimum stumpage rates indicate, little surplus value is available in today's harvests; that situation is expected to worsen in higher cost stands, which on average contain lower-quality timber than that being harvested now.

SECTION 4

Major Policy Implications For Resource Management

This section describes the main areas where policy and program development are needed in the immediate future.

Quality of Resource Management

Maintaining resources in a a sound condition depends on two factors: investment level and management level.

The importance of the first is readily apparent. Timber harvests and range use in the long term cannot exceed the level at which these resources are renewed: this depends on investment. At present, timber harvests are based on higher investment levels and greater program performance than has occurred over the past five years. To bring harvests in line with actual performance, program funding should be a prime consideration in determining allowable cuts. Range and recreation are less affected by investment level than by management level, although some funding problems are being experienced.

The management level is critical to long-term resource productivity. Management refers here to the gamut of decisions from selecting appropriate site-specific treatments to monitoring results. The management level can range from minimal, when broad guidelines govern prescriptions, to intensive, when sites are closely planned and monitored. Either can be satisfactory but minimal management must be accompanied by a conservative approach to resource use to ensure that basic performance standards are met.

Minimal management also requires that general rules be used to regulate activities rather than flexible prescriptions designed for local circumstances. The rules may not facilitate the best performance, but they prevent detrimental effects on the resource base in most circumstances. In many cases, operating costs are higher than they would be under more intensive management. For this reason, the rules arouse criticism and provoke demands that the ministry deregulate. But to accept that alternative would be to neglect legislated responsibilities for resource stewardship.

The ministry's management role and its interactions with the forest industry and other agencies need to be rethought. As with program funding levels, objectives need to be redefined to bring them in line with staff capabilities.

Integrated Resource Management

By and large, a wide variety of resource uses has been successfully incorporated into forest and range land management. However, integrated management faces new challenges. Program interactions absorb an increasing proportion of staff time both within the Ministry of Forests and other agencies, and recent staff reductions will require changes in the negotiating processes that have evolved over the years. Also, the operating constraints imposed to protect the environment and to foster other uses should be re-examined in light of the industry's need to reduce costs to remain viable. Other trends such as the shift in age and species composition of the forest resource, depletion of old-growth stands and expansion of logging into previously untouched areas continue to challenge traditional prescriptions for program integration.

To meet these challenges, use options and priorities need to be identified. Principal issues include rate of harvest within defined areas such as watersheds, retention of old-growth forests where they are desired for wildlife habitat or ecological diversity and protection of community and agricultural water supplies.

Above all, other management agencies want to see integrated management prescriptions given more formal recognition than at present to ensure that nontimber resource uses are adequately protected. They are particularly concerned that the Provincial Forests should include adequate protection for nontimber values. The present plans for integrated use are considered too informal to afford protection for these other values even where timber values are marginal.

Range Management

Historically, range management has concentrated on soil and forage conservation by regulating use under a variety of tenures. More active management has been introduced recently in response to increasing demands on the resource, but these practices are still in their infancy. The absence of an inventory of range carrying capacity and condition has made management decisions difficult. An inventory is now being planned, but it needs to be completed quickly, at least in high-use areas.

Knapweed is an expanding threat to open rangelands. Present containment efforts are insufficient to protect even the highest priority ranges, and knowledge about extent and trends is inadequate for selecting treatment areas and for monitoring results. The alternative to developing an effective control program is to sacrifice these grazing opportunities until a natural or introduced control agent eventually emerges. Considering the value of the resource and the cost of treatment, a control program would be the rational choice.

Recreation Management

Through the Ministry of Forests' recreation management program, recreational and aesthetic values on Crown forest and range lands are protected and developed. Site and trail developments are kept rustic and low key by intent, and are aimed at providing safe, sanitary conditions to enhance public enjoyment of natural surroundings.

Site and trail development has been curtailed over the past two years. Continuing this trend will not only decrease public enjoyment of the resource but also pose management problems in coping with increasing use of unregulated sites.

Recreational values are protected principally through integrated resource use planning. Training programs are being set up for industry and ministry staff to improve the input of recreation planning.

Although the recreation management program is presently reasonably effective, it could be improved. Problems arise because some relevant statutes lack clarity about recreation mandates. The *Forest Act* and the *Ministry of Forests Act* charge the Ministry of Forests with managing forest-oriented recreation, but the responsibilities are not clearly defined. The mandates of some other ministries also have ambiguous references to outdoor recreation. These result in misunderstandings, overlaps and gaps that make accountability for program performance difficult to enforce. A real need exists for government-wide objectives to be developed for forest-oriented recreation and for corresponding management needs and responsibilities to be defined.

Timber Management

It is evident from this analysis that the present forest resource cannot continue to support current harvest rates and still meet the long-term objectives of sustained yield unless forestry programs can achieve the general levels projected in the second *Forest and Range Resource Program* (submitted to the Legislative Assembly on March 11, 1981).

Yield analyses, which are used to establish allowable annual cuts, contain specific assumptions about how much of the present timber inventory will be available for harvest, how quickly new crops will be established following logging or wildfire and how much growth will occur in second-growth forests. It is, therefore, of concern when actual management practices fall short of those assumptions. That basic forestry is falling short is of particular concern. Basic forestry requires that well-stocked healthy young stands be reestablished quickly after forest lands are denuded by logging or wildfire. But reforestation is not currently meeting that objective, and brush competition and insect pests are curtailing growth of established stands. Consequently, long-term harvests will fall below projections unless a commitment is made to close the silviculture gap.

With a resource like timber, for which the renewal period is so long and the annual harvest such a small percentage of the total supply, the consequences of inadequate forestry may not be apparent in the short term. Therefore, actual performance must be incorporated into yield analyses and thereby reflected in allowable annual cuts.

The effects of brush and insect pests have not been addressed as well as was anticipated in the 1980 Forest and Range Five-Year Program. Therefore, results will be less than expected. To the degree that harvest levels were based on those expectations, timber supply objectives will not be met unless pest and brush problems are resolved.

The same is true of intensive forestry. Typically, a yield analysis will indicate that maintaining short-term harvest rates near present levels will cause a precipitous dip in the harvest schedule after two to five decades. The deliberation over setting an allowable annual cut includes judgments about the likelihood of overcoming this deficit through intensive forestry. Because the dip in the supply curve represents a shortage of timber of harvestable size, immediate action is required to advance timber growth to adequate dimensions by the time it is needed. Current intensive management programs fall short of resolving the problem and will not achieve the performance anticipated when the allowable annual cuts were established.

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FOREST AND RANGE RESOURCE ANALYSIS

SUBMITTED TO THE LIEUTENANT GOVERNOR IN COUNCIL
IN ACCORDANCE WITH
SECTION 7 OF THE MINISTRY OF FORESTS ACT

SEPTEMBER 28, 1984

MINISTRY OF FORESTS
HONOURABLE T.M. WATERLAND, MINISTER

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A panel of senior Ministry of Forests staff provided advice on content of the report and accuracy of interpretation of ministry policies. Editorial assistance was provided by Carter Communications Ltd., Vancouver, B.C.

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SECTION A

INTRODUCTION

TO THE

1984 FOREST AND RANGE RESOURCE ANALYSIS

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CHAPTER A1

BACKGROUND

The Forest and Range Resource Analysis is part of a management system that provides a direct link between the ministry and the provincial government. The Five-Year Program and Annual Report are the system's two other components. We describe briefly here all three components to show how the system as a whole operates and how the Resource Analysis fits in.

The Resource Analysis contains an inventory of the resources, assesses their condition and reviews the opportunities for their future use. It is the major source of current information and analysis that the government uses to develop, revise and refine forest and range resource-use policies. It must therefore be comprehensive and directly applicable to the challenges both at hand and in the foreseeable future addressing key issues where government direction is necessary; that is, where the government's choice will significantly affect the way in which resources are administered or managed.

The Five-Year Program provides the government with carefully developed alternatives designed to realize opportunities revealed in the Resource Analysis. Through it, the government selects the alternatives it wishes to fund and sets goals accordingly. Once approved, the Five-Year Program should be viewed as a contract between the government and the Ministry of Forests obliging the ministry to achieve specific goals. And the ministry's annual budget estimates should reflect those goals.

The Annual Report records and evaluates the ministry's performance each year.

In summary, the management system is designed (1) to keep track of the condition of public forest and range resources and the opportunities available for their use, (2) to regularly inform government on these matters, (3) to provide carefully developed program choices designed to take advantage of opportunities, and (4) to keep the government informed about how well the ministry is implementing the program the government has chosen.

The aim of the 1984 Resource Analysis is to focus on the major resource management issues of the 1980's in the context of an up-to-date inventory and an assessment of their condition and management. This report strives to provide an improved information base for understanding the provincial forest and range resources, recognizing government's need for objective analysis to guide resource management policies.

In accordance with Section 7 of the Ministry of Forests Act, the Resource Analysis includes a resource inventory, describes nonproductive and underproductive areas, describes the ministry's programs, analyses trends, forecasts demand and supply, and discusses questions of public policy related to these resources.

Much of the raw data and management information was available from ministry records, but it had not been collated or analysed to meet the needs of the Resource Analysis. Thirty projects were conducted to provide this background. Where the data was too extensive to include in this main report, it has been integrated into a set of detailed Background Reports, which are available for a fee from the Queen's Printers.

The main Resource Analysis report is intended to be of use to elected representatives in government, senior resource managers, members of special interest groups and the informed general public. The Background Reports are intended to provide supplementary information for those who wish to delve into the details of specific projects or to obtain data for reanalysis.

CHAPTER A2

CONTENT OF THE REPORT

The Resource Analysis report is designed to address the current state of forest and range management and to discuss trends and developments and their policy implications. The ten sections cover four main topics:

1. The present extent and condition of the resources;
2. An analysis of present resource management policies and programs;
3. Trends and opportunities for the future;
4. Major policy implications for forest, range and recreation management.

The remainder of Section A outlines the regions into which the province was divided for the purpose of analysing and presenting the data in this report.

Sections B, C and D present an assessment of the extent, quality, condition and use made of public and private forest, range and recreational assets. Where possible, comparisons are made to the 1979 Resource Analysis to illustrate trends or to indicate where new data has resulted in different interpretations. This basic information serves as background to understanding later discussions of resource management and policy issues; it also stands as a solid compendium of factual information to enable comparison in future analyses and to aid development of resource policies over the forthcoming decade.

Section B contains the inventory of forest, range and recreation resources. The forest inventories on both the gross and net productive land bases are projected over the next 100 years to illustrate how the resource will change over time.

Section C describes the condition of these resources and attempts to provide a documented basis for measuring management performance in the future. Statistics are presented on the land area within various condition classes with special attention to the much debated issue of how adequately forests are being regenerated.

Section D contains statistics on timber harvest, range utilization and recreational use. The timber harvest statistics include past harvests by region and year, and project future harvests over the next 100 years. The range use statistics show the extent of Crown range resources and the degree to which they are used for livestock forage. The recreational use statistics contain the available information on the types and amounts of recreational activities supported by Crown lands and the number of facilities managed by the Ministry of Forests and by other agencies.

Sections E and F examine the resource management programs of the Ministry of Forests and also the programs of other agencies that relate to forest and range resources. These sections are intended to take the reader beyond a mere description of what is done and delve into how programs are functioning, examine their strengths and deficiencies and attempt to identify options that could lead to more effective programs and policies.

Section E concentrates on the internal mandate of the Ministry of Forests, illustrating the main goals and discussing how the programs work toward those ends. Major issues within each program are enumerated to indicate where new initiatives must be taken over the next decade.

Section F focuses on integrated resource use. It describes how resource management is coordinated among the various ministries and examines the areas where timber harvesting and grazing by livestock potentially interact with other resource uses and other values. Major issues regarding integrated resource use are highlighted.

Sections G and H address the topic of trends and opportunities for the future. Section G establishes present conditions in the ranching and forest industries as a basis for interpreting emerging patterns of development. The industries are described in terms of their production, their value, the extent of the industries within each region and, in the case of forestry, the number employed. For the ranching industry, the future is discussed in Section G as well, leaving Section H to address the forest industry.

In Section H, information is presented that is relevant to the competitive position of British Columbia's forest industry. It includes statistics on the trends in provincial and international wood costs and on the future demand for forest products. It also includes a discussion of the challenges and opportunities facing British Columbia's forest industry.

Considerable attention is paid to the economic profile of the regions of the province, examining the part that all industries play in providing economic and employment opportunites for their residents. The purpose here is to provide a context within which future decisions about use of forest resources can be placed. While this portion of the report may not be of immediate relevance to the issues that are discussed, it is included to assist in rational policy development as it occurs over the next ten years.

The final chapter of Section H presents an analysis of the logging costs expected to be encountered as the mature timber is logged in four selected timber supply areas. The purpose is to look beyond the cost of what is being logged today to project the operating challenges that must be met in the future as the remainder of the old-growth stock is utilized. Since cost of wood is a significant item in maintaining a viable forest industry, the findings have interesting implications both for government in managing the resource and for industry in adapting to use the changing cost and quality profile of the supply.

Section I addresses the main policy issues that arise from all portions of the report. The main topics include the quality of resource management being practiced in British Columbia, major policies relating to nontimber resources under Ministry of Forests and other agency jurisdiction, and policies affecting management of timber resources. As in the remainder of the report, timber resources and the forest industry are highlighted. Discussion covers the management of the resource including both investment opportunities and the main issues related to the role of the forest industry.

Section J provides summaries of reports prepared by consultants on topics discussed in Sections G and H.

CHAPTER A3

REGIONS FOR ANALYSIS

This report presents data for eight primary subunits of the province (Figure A-1) based on six Ministry of Forests administrative regions with Prince George and Prince Rupert Forest Regions each divided into two parts. They closely approximate the eight regions defined in the 1979 Resource Analysis, but some of their names have been changed to avoid confusion with timber supply areas (TSAs) and other agencies' management regions. The comparable names in the two documents are given below.

1984 Resource Analysis	1979 Resource Analysis
Cariboo	Cariboo
Kamloops	Kamloops
Nelson	Nelson
Prince George Northeast (NE)	Peace River
Prince George	Prince George
Prince Rupert Interior	Bulkley-Northwest
Prince Rupert Coast	Prince Rupert
Vancouver	Vancouver

Some boundaries have also been changed since the 1979 Resource Analysis but these are generally inconsequential for statistical comparisons. An exception is the boundary between Vancouver and Prince Rupert Forest Regions which resulted in the Mid-Coast TSA, previously part of the Prince Rupert Forest Region, becoming part of the Vancouver Forest Region. Throughout this report, the effects on reported statistics are identified.

Biogeoclimatic zones are referred to throughout the report. These are shown in Figure A-2.

CARIBOO REGION

The Cariboo region which covers 8,676,965 hectares lies entirely on the Interior Plateau dissected into east and west sections by the Fraser River. The west section, traditionally known as the Chilcotin, is gently rolling. The east is more mountainous and includes the Quesnel Highlands, the Cariboo Mountains, and the Camelsfoot and Marble Ranges. Since the Interior Plateau is in the rainshadow of the Coast Mountains, it is one of the province's drier areas.

Figure A-1

BOUNDARIES OF RESOURCE ANALYSIS REGIONS

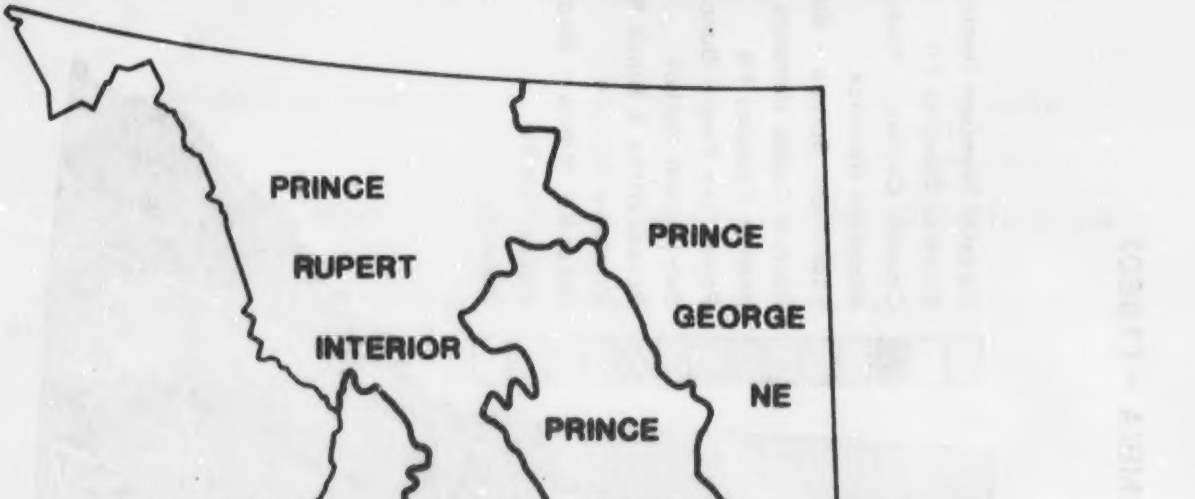
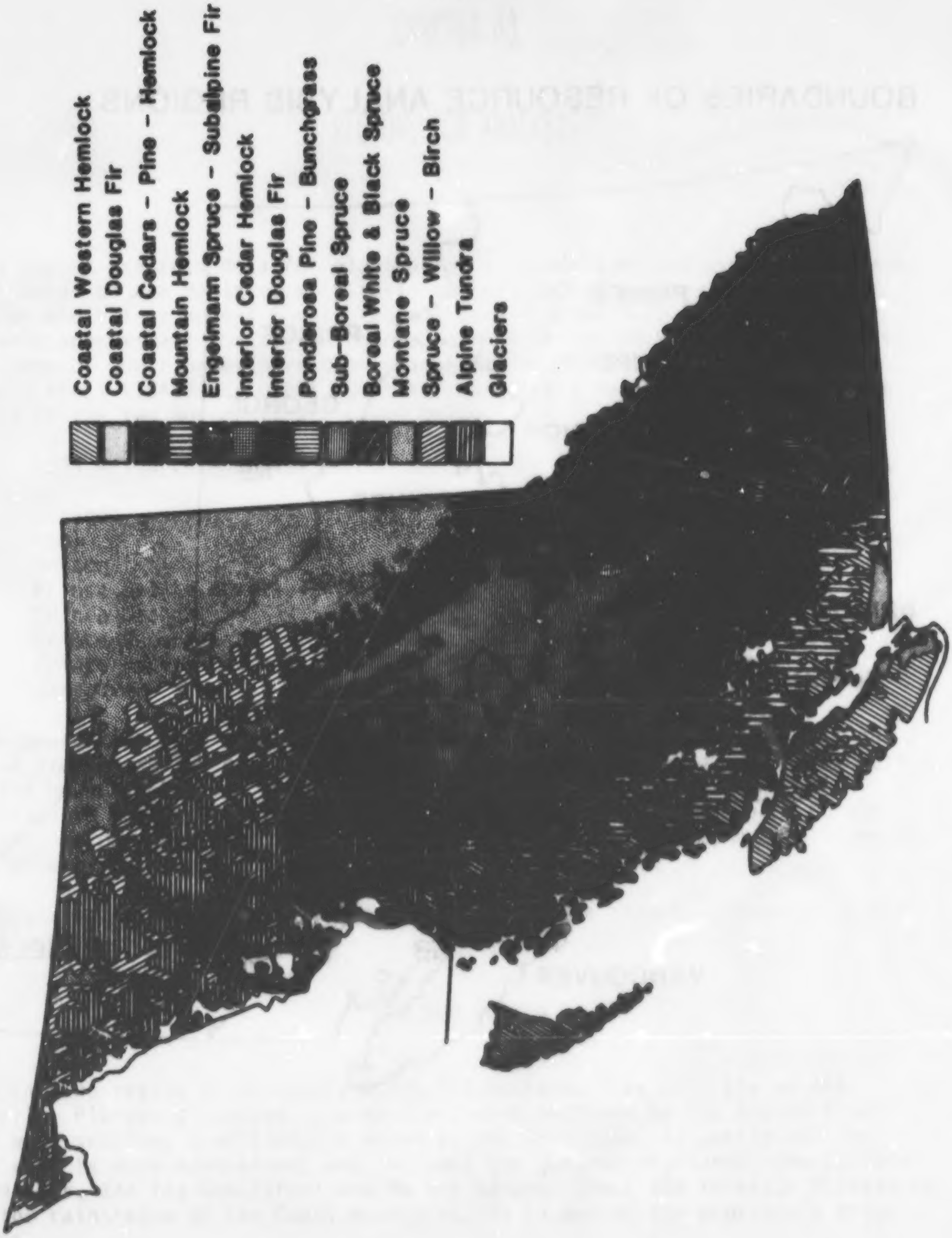

PRINCE
RUPERT
INTERIOR
PRINCE
GEORGE
NE
PRINCE
GEORGE
PRINCE
RUPERT
COAST
CARIBOO
KAMLOOPS
NELSON
VANCOUVER

Figure A-2

BIOGEOCLIMATIC ZONES OF BRITISH COLUMBIA - (1980)


Coastal Western Hemlock
Coastal Douglas Fir
Coastal Cedars - Pine - Hemlock
Mountain Hemlock
Engelmann Spruce - Subalpine Fir
Interior Cedar Hemlock
Interior Douglas Fir
Ponderosa Pine - Bunchgrass
Sub-Boreal Spruce
Boreal White & Black Spruce
Montane Spruce
Spruce - Willow - Birch
Alpine Tundra
Glaciers

Biogeoclimatic zones in the Cariboo region include Interior Douglas Fir (IDF) and Ponderosa Pine-Bunchgrass (PPBG). Associated with these zones are the following inventory growth types: fir, cedar, western white pine, lodgepole pine and ponderosa pine

Quesnel, Williams Lake and 100 Mile House are centres of the local forest industry. Timber supplies are principally drawn from one tree farm licence (TFL) and three timber supply areas (TSAs):

TFLs	TSAs
#5 - Weldwood of Canada Ltd.	#23 - 100 Mile House
	#26 - Quesnel
	#29 - Williams Lake

Parts of three major provincial parks covering more than 600,000 hectares are found in the region.

The following general range types are present: open range, wetland, ponderosa pine forest and lodgepole pine.

KAMLOOPS REGION

The Kamloops region lies on the Interior Plateau and covers 6,741,684 hectares. Sections of the Coast Mountains are included on the west and part of the Cascade Mountains on the southwest. The Interior Plateau is dissected by numerous valleys so it appears to be flat-topped hills. Some of the main valleys (for example the Okanagan and Similkameen) are as deep as 1200 metres. Most of the region is in the rainshadow of the Coast Mountains with precipitation averaging as little as 350 mm in the semiarid valleys. The uplands and mountain areas receive more moisture and moderate-to-thick forests replace the grasslands at lower elevations.

Biogeoclimatic zones in the Kamloops region include Interior Douglas Fir (IDF), Ponderosa Pine-Bunchgrass (PPBG) and Mountain Hemlock (MH).

Commonly associated with these zones in the Kamloops region are the following inventory growth types: fir, cedar, western white pine, lodgepole pine, ponderosa pine, hemlock and balsam.

Kamloops, Penticton and Merritt are the centres of the local forest industry. Timber supplies are drawn from seven TFLs and four TSAs:

TFLs	TSAs
#9 - Crown Forest Industries Ltd.	#11 - Kamloops
#15 - Weyerhaeuser Canada Ltd.	#15 - Lillooet
#16 - Crown Forest Industries Ltd.	#18 - Merritt
#18 - Clearwater Timber Prod. Ltd.	#22 - Okanagan
#32 - Crown Forest Industries Ltd.	
#33 - Federated Cooperatives Ltd.	
#35 - Weyerhaeuser Canada Ltd.	

Parts of two major provincial parks covering more than 500,000 hectares are found in the region.

The following general range types are present: open range, wetland, ponderosa pine forest, dry forest, lodgepole pine forest and wet forest.

NELSON REGION

The Nelson region covers 7,500,758 hectares and is composed of three distinct physiographic areas: the East Kootenay with the Rocky Mountain Trench; the Central Kootenay between the Purcells and Selkirk Mountains; and the West Kootenay between the Selkirk and Monashee Mountains. The successive mountain ranges create a variety of climates. The annual precipitation on the westward slopes is second only to the coast while the narrow valleys are semiarid.

Biogeoclimatic zones in the Nelson region include Interior Douglas Fir (IDF), Interior Cedar Hemlock (ICH), Englemann Spruce-Subalpine Fir (ESSF) and Mountain Hemlock (MH). Associated with these zones in the Nelson region are the following inventory growth types: fir, cedar, western white pine, lodgepole pine, ponderosa pine, larch, hemlock, spruce and balsam.

Castlegar, Nelson, Cranbrook, Creston and Invermere are some of the major centres of the local forest industry. Timber supplies are drawn from five TFLs and seven TSAs.

TFLs

#3 - Slocan Forest Prod. Ltd.
#8 - Pope and Talbot Ltd.
#13 - Galloway Lumber Co. Ltd.
#14 - Crestbrook Forest Ind. Ltd.
#23 - Westar Timber Ltd.

TSAs

#1 - Arrow
#2 - Boundary
#5 - Cranbrook
#7 - Golden#
#9 - Invermere
#13 - Kootenay Lake
#27 - Revelstoke

A total of six federal and provincial parks covering more than 500,000 hectares are found in the region.

The following general range types are present: open range, wetland, alpine, ponderosa pine forest, dry forest, lodgepole pine, wet forest, deciduous forest and transitional.

PRINCE GEORGE NORTHEAST REGION

The Prince George Northeast region covers 15,856,337 hectares. Most of the region is flat except for the deeply cut valleys of the large rivers. The two major rivers are the Liard, which drains northward into the Northwest Territories, and the Peace, which flows eastward into Alberta. The region's climate is similar to that of northern Alberta and Saskatchewan. Precipitation averages 400-500 mm. The region receives up to 18 hours of daylight during the summer months but the winter is long, cold and relatively dry.

Biogeoclimatic zones in this region include Englemann Spruce-Subalpine Fir (ESSF), Boreal White and Black Spruce (BWBS) and Sub Boreal Spruce (SBS).

Associated with these zones are the following inventory growth types: spruce, western white pine and lodgepole pine.

Fort Nelson, Chetwynd and Ft. St. John are the major centres of the local forest industry. Timber supplies come exclusively from two TSAs: Fort Nelson (#8) and Peace (#6).

Two major provincial parks covering over 250,000 hectares are found in the region.

The following general range types are present: wetland, lodgepole pine and deciduous forest.

PRINCE GEORGE REGION

The Prince George region covers 13,713,460 hectares. It contains the northern part of the Interior Plateau, the Omineca Mountains to the north, sections of the Rocky Mountain Trench to the east and part of the Cariboo Range to the south. Though part of the region is in the rainshadow of the Coast Mountains, it is significantly wetter than areas to the south. The region's climate is continental, characterized by long, cold winters and short, cool summers.

Biogeoclimatic zones in this region include Ponderosa Pine-Bunchgrass (PPBG), Englemann Spruce-Subalpine Fir (ESSF), Interior Cedar Hemlock (ICH), and Mountain Hemlock (MH). Associated with these zones are the following inventory growth types: fir, ponderosa pine, spruce, western white pine, lodgepole pine, cedar, hemlock, and balsam.

The Prince George region supports a major forest industry, with Prince George and Mackenzie being the principal centres. Timber supplies are drawn from two TFLs and three TSAs.

TFLs	TSAs
#30 - Northwood Pulp & Timber Ltd.	#16 - Mackenzie
#42 - Tanizul Timber Ltd.	#17 - McBride
	#24 - Prince George

Two major provincial parks covering more than 200,000 hectares are found in this region.

The following general range types are present: open range, ponderosa pine forest, lodgepole pine forest, wet forest and transitional.

PRINCE RUPERT INTERIOR REGION

The Prince Rupert Interior region is the largest of the eight regions, covering 22,158,308 hectares, about one-quarter of British Columbia. The region is composed of two major physiographic regions: the northern section of the Coast Mountains and the western section of the Central Plateau. Within these two broad areas are more than a half dozen mountain ranges, several plateaus, plains and basins. The region's climate is characterized by long, cold winters and short, cool summers. Annual precipitation generally decreases from west to east and from the higher elevations to the valleys. Permafrost is common in the northern areas.

Biogeoclimatic zones in this region include Interior Cedar Hemlock (ICH), Sub Boreal Spruce (SBS), Mountain Hemlock (MH), and Englemann Spruce-Subalpine Fir (ESSF). Associated with these zones are the following inventory growth types: fir, cedar, hemlock, lodgepole pine, spruce and balsam.

Smithers and Houston play large roles in the regional forest industry. The area includes five TSAs:

TSAs

#3 - Bulkley
#4 - Cassiar
#12 - Kispiox
#14 - Lakes
#20 - Morice

Three major provincial parks covering more than 1,000,000 hectares are found in the area.

The following general range types are present: wetland, lodgepole pine, wet forest, deciduous and transitional.

PRINCE RUPERT COAST REGION

The Prince Rupert Coast region covers 8,377,608 hectares. The mainland portion is mountainous and the coastline is deeply penetrated by narrow, steep-walled fjords and channels which provide sheltered, navigable waterways. The western sides of the Queen Charlotte Islands are mountainous while the eastern sides have relatively low relief. The region has a maritime climate, characterized by moderate temperatures year round and heavy precipitation.

Biogeoclimatic zones in this region include Coastal Western Hemlock (CWH) and Mountain Hemlock (MH). Associated with these zones are the following inventory growth types: fir, cedar, hemlock, balsam, spruce and lodgepole pine.

Prince Rupert, Terrace, Kitimat, Juskatla and Queen Charlotte City are the centres of the forest industry. Timber supplies are drawn from portions of three TFLs and five TSAs. TFLs 2, 25 & 39 are partially in the Prince Rupert Coast region and partially in the Vancouver region.

TFLs

#1 - Westar Timber Ltd.
#2 - Crown Forest Industries Ltd.
#25 - Western Forest Products Ltd.
#39 - MacMillan Bloedel Ltd.
#41 - Eurocan Pulp and Paper Co. Ltd.

TSAs

#10 - Kalum
#21 - North Coast
#25 - Queen Charlotte

The following general range types are present: small areas of wetland, wet forest, transitional and deciduous.

VANCOUVER REGION

The Vancouver region covers 7,545,053 hectares much of which is mountainous and includes the Pacific Coast Mountains, the Insular Mountains on Vancouver Island, and a section of the Cascade Mountains. Its climate is mild and wet due to the influence of the Pacific Ocean.

Biogeoclimatic zones found in the region include Coastal Western Hemlock (CWH), Coastal Douglas Fir (CDF), Mountain Hemlock (MH), Interior Douglas Fir (IDF) and Englemann Spruce-Subalpine Fir (ESSF). Associated with these zones are the following inventory growth types: fir, cedar, hemlock, balsam, spruce and lodgepole pine.

Vancouver, Nanaimo, Campbell River and Port Alberni are only a few of the major centres for a large and diverse forest industry. Timber supplies are drawn from 15 TFLs and 6 TSAs. Some of the TFLs are only partly in the Vancouver region.

TFLs

#2 - Crown Forest Industries Ltd.
#6 - Western Forest Prod. Ltd.
#7 - MacMillan Bloedel Ltd.
#10 - Weldwood of Canada Ltd.
#12 - Crown Forest Ind.(Hardwicke Isl.)
#19 - Tahsis Co. Ltd.
#25 - Western Forest Products Ltd.
#26 - The Corporation of the District of Mission
#37 - Canadian Forest Products Ltd.
#38 - Empire Mills Ltd.
#39 - MacMillan Bloedel Ltd.
#43 - Scott Paper Ltd.
#44 - MacMillan Bloedel Ltd.
#45 - British Columbia Forest Products Ltd.
#46 - British Columbia Forest Products Ltd.

TSAs

#19 - Midcoast
#30 - Fraser
#31 - Soo
#32 - Quadra
#33 - Kingcome
#34 - Nootka

Five major provincial parks covering more than 500,000 hectares are found in this region.

The following general range types are present: wetlands, ponderosa pine forest, lodgepole pine forest and transitional.

SECTION B

INVENTORY OF FOREST, RANGE AND RECREATION RESOURCES

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CHAPTER B1

THE FOREST LAND BASE

This chapter provides an estimate of the anticipated withdrawals from the land base over the next 20 years for such purposes as farm lands, watershed reserves, wildlife preserves, ecological reserves and recreational reserves. This information will allow us to realistically predict the land area that will be available for forest management in the future.

The intent of Chapter B1 is to arrive at an estimate of the size of the forest land base which the Ministry is reasonably confident will remain under timber harvest. Subsequent chapters, B2 and B3, portray different aspects of the forest resource. Although each chapter starts from the same data base, the data are used differently and a direct comparison between chapters is not possible.

The calculation starts with the total land area within a timber supply area or tree farm licence, and then reduces this area by subtracting land classifications which do not contribute to the productive Crown forest land base. Any form of land tenure which precludes Ministry of Forests' management of the forest resource is considered an alienation. This includes small parks and Crown grants (private land). Although alienated lands contain some of the most productive forest land in the province, they are not under Ministry of Forests' management and have been deducted from the Crown land base. Crown granted lands within certified tree farms form the largest area of private lands which are managed for timber production.

The Crown land area that remains is then reduced by subtracting unproductive lands; that is land which the forest inventory lists as incapable of growing a merchantable stand within a reasonable length of time. This includes alpine forest, open range and forests growing on swamp, muskeg, and steep, rocky, broken sites.

What remains is considered productive forest land. Since this area must still serve a variety of uses, further adjustments are made to account for their effects on the potential timber harvest.

Environmentally Sensitive Areas (ESAs) and areas where withdrawal of forest land for other uses, such as farms, reservoirs and power lines is either in progress or highly probable within the next 20 years, are subtracted from the productive land base.

Anticipated withdrawals are made for those areas which are expected to be withdrawn permanently from the forest land base within the next 20 years. They include potential parks, urban and agricultural settlement areas, hydro developments including flooding, mining activities, roads, highways, railways, ecological reserves and areas of single use natural resource management.

Such competing uses would have no immediate impact upon allowable annual cut, since the timber could be harvested in conjunction with the removal of the area from the forest land base, but they would affect the long run sustained yield by reducing the land base available for succeeding harvests.

Those areas, which are in the process of deletion but have not yet been recorded, are defined as withdrawals in process and are removed from the forest land base.

The area left after these reductions is called the available forest land base, which is the amount of productive forest land currently available for timber production.

There are still areas, though productive and available, not currently commercially viable. These include inaccessible (inoperable) areas, noncommercial tree species and nonmerchantable forest cover (Problem Forest Types).

Other areas, although potentially productive, do not currently support a stand of commercially usable species. These include areas, which have been disturbed through fire or logging and have not satisfactorily restocked, where stocking following disturbance is doubtful and needs checking, and areas covered by noncommercial brush such as willow, wildrose or salmonberry.

The land remaining after all deductions have been made is defined as the net presently productive, available and suitable land base.

Information on the productive but unavailable forest land was obtained in several ways. The data on environmentally sensitive areas was obtained from TSA reports and by direct communication with Ministry of Forests Regional offices.

Data on some of the anticipated withdrawals were obtained from TSA reports and include local trends in agriculture, settlement, recreation, hydro and mines, roads, highways, and railways. The predicted trends were reviewed by Ministry of Forests regional staff to confirm their probable accuracy.

Data on other anticipated withdrawals were produced from information on:

(1) major new developments that, based on past observations, may be expected to require land use decisions within a 20 year period,
(2) existing broad trends in resource management and
(3) potential impacts of policies resulting from current legislation.

Data on withdrawals in process were produced in different ways depending on the type of withdrawal. Information on new lease tenures issued by the Ministry of Lands, Parks & Housing (excluding grazing leases and foreshore leases) and all new acquisitions of parkland was obtained from the Ministry's Annual Reports and from its Provincial Parks List.

The estimate of land lost to timber production through the establishment of permanent roads, landings, highways and railways was calculated by fixing this loss at 2% of the average annual area logged multiplied by the number of years since the last Resource Analysis. The average annual area logged is that reported in the 1979 Resource Analysis, partly because that Analysis reported figures from a more stable economic climate.

The results of these calculations are presented in Tables B-1, B-2 and B-3. Background Report #1 contains more detailed data, which tabulate the above information for each Resource Analysis region. Tables are also provided for each individual TSA and TFL.

The area of productive 'Forest Land' is now reported as 43.3 million hectares, considerably below the total of 47.4 million hectares in the 1979 Resource Analysis. Much of this difference is in the classification of forest land as productive or nonproductive in the northern parts of the province. In the Prince Rupert Interior region, for example, approximately 2 million hectares previously shown as low site are now included under nonproductive. Another discrepancy arises from the Special Sales Areas that in 1979 stood as identifiable regulated units. These areas have been subjected to careful review to determine which portion will likely remain in timber production. Some of that timber inventory has already been incorporated in statistics for adjacent TSAs but the disposition is not yet finalized. It is possible that up to 500,000 hectares could be added to productive forest land statistics upon further analysis.

In the Cariboo region, land withdrawals over the next 20 years are estimated at 188,000 ha. An additional 114,580 ha are now in process for a total of 302,580 ha. The 1979 Resource Analysis estimated that 343,000 ha of productive forest land would be removed from the forest land base over the next 20 years. Actual losses during the five years since the Resource Analysis were approximately 114,000 ha, which is 33% of the projected total. This is high if we assume that annual land losses remain relatively constant over a 20-year period. Since 1979, the Ministry of Lands, Parks & Housing and the Ministry of Forests, under the Deferred Planning Area Program, identified about 250,000 ha of nonforest area of which about 100,000 ha previously would have been considered long-term productive land. These areas should accommodate nonforest use for some years to come and reduce pressure on the remaining productive forest land base.

In the Kamloops region, withdrawals are estimated to be 194,000 ha over the next 20 years plus 10,501 ha now being processed for a total of 204,501 ha. This is considerably higher than the 1979 Resource Analysis estimate of 99,000 ha of productive forest land. The dramatic increase in the present estimate is due to the inclusion of 110,000 ha of park and miscellaneous major land withdrawals. The potential for future large scale losses to parks and other resource values is thereby acknowledged.

In the Nelson region, future land withdrawals over the next 20 years are estimated at about 137,000 ha plus 11,544 ha now in process for a total of 148,544 ha. During the past 5 years, an estimated 61,500 ha has been removed from the forest land base. The bulk of the area removed occurred through the creation of Valhalla Park (50,000 ha). No further comparably large withdrawals are anticipated in the next 20 years.

Table B-1. Provincial TSA and TFL Area Summary

		Area in Hectares
TOTAL AREA - Excluding major parks		88,907,918
Alienations		
- Crown Grants		
- Parks		
Total Alienations	6,938,022	
UNALIENATED AREA		81,969,896
Non Forest		
- Alpine Forest		
- Water		
- Open Range		
Total Not Productive	38,705,293	
FOREST LAND		43,264,603
Land Losses Accounted For in TSA Reports		
- ESAs and Land Withdrawals		
Total Not Available	2,383,746	
AVAILABLE FOREST LAND		40,880,857
Not suitable		
- inoperable		
- problem forest types		
Total Not Suitable	14,713,917	
POTENTIALLY PRODUCTIVE AVAILABLE AND SUITABLE		26,166,940
Not Stocked		
- NSR/DSD		
- NC		
Total Not Stocked	3,560,368	
PRESENTLY PRODUCTIVE AVAILABLE AND SUITABLE		22,606,572
Land Losses Not Accounted For in TSA Reports		
Total Additional Not Available	1,316,226	
NET PRESENTLY PRODUCTIVE AVAILABLE AND SUITABLE		21,290,346

Table B-2. Provincial TSA Area Summary

		Area in hectares
TOTAL AREA - Excluding major parks		81,359,031
Alienations		
- Crown Grants		
- Parks		
Total Alienations	6,325,056	
UNALIENATED AREA		75,033,975
Non Forest		
-Alpine Forest		
-Water		
- Open Range		
- Not Separated		
Total Not Productive	35,488,643	
FOREST LAND		39,545,332
Land Losses Accounted For in TSA Reports		
- ESAs and Land Withdrawals		
Total Not Available	2,285,939	
AVAILABLE FOREST LAND		37,259,393
Not Suitable		
- inoperable		
- problem forest types		
Total Not Suitable	13,908,719	
POTENTIALLY PRODUCTIVE AVAILABLE AND SUITABLE		23,350,674
Not Stocked		
- NSR/DSD		
- NC		
Total Not Stocked	3,386,928	
PRESENTLY PRODUCTIVE AVAILABLE AND SUITABLE		19,963,746
Land Losses Not Accounted For in TSA Reports		
Total Additional Not Available	1,316,226	
NET PRESENTLY PRODUCTIVE AVAILABLE AND SUITABLE		18,647,520

Table B-3. Provincial TFL Area Summary

		Area in hectares
TOTAL AREA - Excluding major parks		7,548,887
Alienations		
- Crown Grants		
(includes about 570,000 ha of productive forest land)		
- Parks		
- Miscellaneous		
Total Alienations	612,966	
UNALIENATED AREAS		6,935,921
Not Productive		
- Alpine Forest		
- Water		
- Open Range		
- Other		
Total Not Productive	3,216,650	
FOREST LAND		3,719,271
Land Losses Accounted For in TSA Reports		
- ESAs and Land Withdrawals		
Total Not Available	97,807	
AVAILABLE FOREST LAND		3,621,464
Not Suitable		
- inoperable		
- problem forest types		
Total Not Suitable	805,198	
POTENTIALLY PRODUCTIVE AVAILABLE AND SUITABLE		2,816,266
Not Stocked		
- NSR/DSD		
- NC		
Total Not Stocked	173,440	
PRESENTLY PRODUCTIVE AVAILABLE AND SUITABLE		2,642,826

Projected withdrawals in this Analysis compare favorably to the 1979 Resource Analysis estimate with the slight reduction due to refinements in the estimated withdrawals for individual TSAs.

In the Prince George Northeast region, withdrawals over the next 20 years are expected to total 272,000 ha, plus 91,956 ha now in process, for a total of 363,956 ha. The 1979 Resource Analysis estimated that 596,500 ha of productive forest land would be removed from the forest land base over the next 20 years. Actual losses during the five-year period since the 1979 estimates were made were approximately 92,000 ha. Thus, land losses were overestimated during the 1979 Analysis by 228,500 ha or 62%, assuming the rate of land loss would be constant over a 20-year period.

In the Prince George region, land withdrawals are predicted to be 268,000 ha over the next 20 years plus 135,670 ha lost over the past 5 years for a total of 403,670 ha. This is close to the 1979 Resource Analysis estimate of 412,500 ha.

Since the 1979 Analysis, work on defining the forest and nonforest areas has been done by the Ministries of Lands, Parks & Housing and Forests. This has resulted in identification of about 128,000 ha of nonforest area of which approximately 71,500 ha would have previously been considered long-term productive forest land. These areas should accommodate nonforest use for some years to come and thus reduce pressure on the remaining productive forest land base.

In the Prince Rupert Interior region, withdrawals of productive forest land over the next 20 years are expected to be nearly 128,000 ha plus 11,373 ha now being processed, for a total of 139,373 ha. This is significantly less than the 1979 Resource Analysis estimate of 289,000 ha. Actual productive land losses during the past five-year period were about 11,560 ha or approximately 4% of the total estimate for the entire 20 year period. A large part of the difference is due to the reclassification of land from accessible to inaccessible.

In the Prince Rupert Coast region, future withdrawals over the next 20 years are estimated at 214,000 ha plus another 1,083 ha now being processed, for a total of 215,083 ha. This is significantly less than the 1979 Resource Analysis estimate of 435,480 ha of productive forest land (adjusted for the boundary change that moved the Mid-Coast TSA to the Vancouver Region). Actual losses during the five-year period since these estimates were made include only the lands now being processed. We do not expect that the level of land losses predicted in 1979 will be reached but losses will still be high due to the value and importance of other resources. For example, the 1979 Analysis included an estimate for loss of area on South Moresby Island. This issue had not been resolved by the end of 1983, as originally anticipated, and the actual land losses reported are therefore considerably less than they could have been.

In the Vancouver Region, anticipated future withdrawals total 18,000 ha and 14,519 ha of withdrawals are now in process for a total of 32,519 ha.

Actual recorded losses since 1979 are approximately 14,500 ha or 21% of the 1979 estimate. Much of this loss occurred in the form of Land Act tenures and park acquisitions within the boundaries of the Vancouver Forest Region as it existed in 1979.

CHAPTER B2

FOREST INVENTORY STATISTICS

The Ministry of Forests' Inventory Branch compiles inventory data for all forested Crown land in the province except for tree farm licences. Tree farm licence holders are responsible for maintaining their own up-to-date inventory to a standard set by the Forest Service.

Early inventories were based on reconnaissance surveys, with reports published in 1918 and 1937. The first comprehensive report, published in 1957, was based on standard surveys carried out by the Forest Service. The Forest Service continued to improve and expand the inventory methods and in 1969 published the first issue of Forest Inventory Statistics of British Columbia. Revised reports were issued in 1972 and 1975. At the end of the period, the forest resources on Crown land had been inventoried at least twice resulting in a large data base.

In 1973 the inventory program was expanded to include the identification of environmental protection areas (EPAs). These areas, now referred to as "environmentally sensitive areas" (ESAs), are sensitive to disturbance or have a higher value for some other resource use. Areas which are subject to timber harvesting constraints in the ESA Program include areas susceptible to slides because of unstable soil or slope steepness, areas where it will be difficult to regenerate a new crop, avalanche tracks or snow chutes, high recreational and watershed value areas, essential habitat for wildlife and fish, and areas which, due to soil or topography, are subject to damage from improper harvesting.

For much of the province the original inventory data base was unable to satisfy the needs of forest managers. Recently, with the growing need for more intensive forest management the old forest classification system has been redesigned and the latest computer technology applied to provide a detailed and current data base. More details about inventory procedures are given in Chapter E4, Inventory Subprogram.

CLASSIFICATION SYSTEM

The two primary components of forest classification are land area and tree species. Each of these is broken down into more specific categories as shown in Table B-4.

Table B-4. Classification of the Forest Land Base

PRODUCTIVE		NONPRODUCTIVE
Site Class	Not Stocked	
- Good	- NSR/DSO	- Alienated
- Medium	- NC	- Barren - Swamp
- Poor		- Alpine, Scrub
- Low		- Range & Meadow
		- Water

SPECIES	
AGE CLASS	SPECIES TYPE
- Mature	- Type Group
- Immature	

The age of a stand of trees is the average age of the dominant and codominant trees. Stands are separated into two age class categories, mature and immature. Mature stands are defined as those over 120 years for all coniferous species other than lodgepole and whitebark pine. These two species and all deciduous species are considered mature at 81 years. Stands are assigned an age class code of from 1 to 9. From 1 to 7 the class intervals are 20 years, that is for age class 7, stands are between 121 and 140 years old. Age class 8 extends from 141 years to 250 years and age class 9 includes all trees older than 250 years.

The 28 commercial tree species in British Columbia have been grouped into 42 well defined associations or "Inventory Type Groups". These groups are assigned a numeric code and named according to the dominant or leading species represented in that area. Occasionally a stand contains two almost equal species, resulting in a type group name which combines both the leading and secondary species.

Inventory type groups with common leading species can be combined into growth types. For the purpose of the Resource Analysis the following ten growth types have been defined:

Type Groups	Growth Types
1 - 8	Fir
9 - 11	Cedar
12 - 17	Hemlock
18 - 20	Balsam
21 - 26	Spruce
27	Western White Pine
28 - 31	Lodgepole Pine
32	Ponderosa Pine
33 - 34	Larch
35 - 42	Deciduous

Although tree species are most commonly found in association with their respective growth types (for example Douglas-fir in the fir growth type), this does not preclude the occurrence in stands of other growth types (for example the common occurrence of interior Douglas-fir in the Ponderosa Pine growth type). A leading species is dominant because the site is more conducive to the growth of that species than any of the others.

Distribution of the 'growth types' throughout the province depends upon the relative capabilities of sites to fulfill the hydrologic and edaphic needs of the leading/secondary species. Division of the province into biogeoclimatic zones is a method of describing and grouping sites which exhibit common climatic and edaphic environments and in turn support the growth of similar vegetative associations. Biogeoclimatic zones were first delineated by Dr. V.J. Krajina in 1965. They are defined as geographic areas with broadly homogenous climate and patterns of ecosystems and are characterized by closely related ecosystem associations, climatic characteristics and a unique combination of species. The following descriptions indicate the ecological distribution of growth types while the geographic locations are illustrated in Chapter B6.

Fir Type (1 - 8): This growth type is found within five provincial biogeoclimatic zones:

1. Coastal Douglas Fir (CDF)
2. Coastal Western Hemlock (CWH)
3. Interior Douglas Fir (IDF)
4. Interior Cedar Hemlock (ICH)
5. Ponderosa Pine-Bunchgrass (PPBG)

Generally, the Douglas-fir type grows best on rich, wet soils. At lower elevations on the coast Douglas-fir grows in association with grand fir, lodgepole pine and western red cedar. Further north along the coast and at higher elevations western hemlock, western white pine, sitka spruce and balsam fir are added to the common growth association.

In the interior, Douglas-fir is found on dry sites ranging from forested areas to grasslands. In the forested areas ponderosa pine, western white pine, lodgepole pine, Engelmann spruce, grand fir, western red cedar, western hemlock and western larch are commonly associated tree species. On grasslands Douglas-fir grows in association with ponderosa pine.

Cedar Type (9 - 11): This growth type occurs in limited amounts within four biogeoclimatic zones:

1. Coastal Douglas Fir (CDF)
2. Coastal Western Hemlock (CWH)
3. Interior Douglas Fir (IDF)
4. Interior Cedar Hemlock (ICH)

The western red cedar type typically grows best on rich, wet soils. In coastal areas western red cedar grows in association with Douglas-fir, grand fir, western hemlock, sitka spruce and western white pine. In the interior, it grows in close association with grand fir and western hemlock.

Hemlock Types (12 - 17): This growth type is found in three of the biogeoclimatic zones:

1. Coastal Western Hemlock (CWH)
2. Interior Cedar Hemlock (ICH)
3. Mountain Hemlock (MH)

Best growth of the hemlock type occurs on wet soils of poor nutrient status. On the coast, it grows in association with Douglas-fir, grand fir and western red cedar. In the interior it grows in association with western red cedar. Mountain hemlock can be found at higher elevations in association with subalpine fir.

Balsam Type (18 - 20): The balsam type occurs in two biogeoclimatic zones:

1. Coastal Western Hemlock (CWH)
2. Mountain Hemlock (MH)

The balsam type typically grows on rich, wet soils. In coastal areas at lower and moderate elevations balsam fir can be found growing with sitka spruce, western hemlock and western red cedar. At higher elevations balsam fir is found along with Engelmann spruce and subalpine fir.

Spruce Type (21 - 26): The 4 major spruce species are widely distributed provincially with one or more species occurring in 4 biogeoclimatic zones:

1. Engelmann Spruce-Subalpine Fir (ESSF)
2. Boreal White and Black Spruce (BWBS)
3. Sub Boreal Spruce (SBS)
4. Coastal Western Hemlock (CWH)

Generally, the spruce type grows best on rich, wet soils. Black spruce is the exception favouring nutrient-poor wet sites. Engelmann spruce can be found throughout the province from moderate elevations up to the alpine zone. It grows in association with subalpine fir and western white pine. In the northern areas both white and black spruce are present. Sitka spruce is found on the coast at low elevations in association with balsam fir and western red cedar.

Western White Pine (27): This type is found in five biogeoclimatic zones:

1. Engelmann Spruce-Subalpine Fir (ESSF)
2. Coastal Western Hemlock (CWH)
3. Interior Douglas Fir (IDF)
4. Interior Cedar Hemlock (ICH)
5. Mountain Hemlock (MH)

This type shows its best growth on rich, wet soils. Western white pine can be found growing at moderate to higher elevations throughout the province in association with subalpine fir, Engelmann spruce, mountain hemlock, lodgepole pine and Douglas-fir. On the coast western white pine grows in association with Douglas-fir, western red cedar and grand fir. In the interior, western white pine grows with lodgepole and ponderosa pines and western hemlock.

Lodgepole Pine Type (28 - 31): This type is widely distributed, occurring principally within five biogeoclimatic zones:

1. Coastal Western Hemlock (CWH)
2. Coastal Douglas Fir (CDF)
3. Interior Cedar Hemlock (ICH)
4. Interior Douglas Fir (IDF)
5. Engelmann Spruce-Subalpine Fir (ESSF)

The lodgepole pine type grows best on rich, wet soils. On the coast, lodgepole pine grows in association with Douglas-fir and western hemlock. In the interior, it grows in association with Douglas-fir, western white pine and western hemlock. Lodgepole pine also occurs at moderate elevation throughout the province in association with Douglas-fir, western white pine, Engelmann spruce and subalpine fir. Throughout the interior, lodgepole pine is shade intolerant and usually repressed by associated species. As a result, it rarely grows to 100 years of age and lends itself to management on a short rotation basis.

Ponderosa Pine Type (32): This type is found in three biogeoclimatic zones:

1. Ponderosa Pine-Bunchgrass (PPBG)
2. Interior Douglas Fir (IDF)
3. Interior Cedar Hemlock (ICH)

This type exhibits its best growth on rich, dry soils. Throughout the interior, Ponderosa pine can be found growing in association with lodgepole and western white pines, Douglas-fir, western larch and western hemlock.

In grassland areas it is highly susceptible in its juvenile stage to grazing disturbance. Douglas-fir, western larch, western hemlock and western white pine all provide severe competition.

Larch Type (33 - 34): This type occurs in two biogeoclimatic zones:

1. Interior Douglas Fir (IDF)
2. Interior Cedar Hemlock (ICH)

Typically this species grows best on rich wet soils. Larch is found in the interior growing in association with Douglas-fir and lodgepole pine.

Deciduous Type (35 - 42): This type can be found in both coastal and interior areas of the province. As a transitional, successional species group, it prepares the site for the next species in the successional chain. Certain deciduous types occupy the site over a long transitional period resulting in a delay in establishment of the next, usually more commercially important successional species. On the coast this situation is typified by alder impeding the establishment of Douglas-fir.

TREATMENT OF INVENTORY DATA

The volumes for each growth type are based on regional growth and yield tables. Growth and yield projections are based on yield tables developed for natural stands. ("Natural stands" are forest stands that have not received any silvicultural treatment). Yield Tables discussed in this section are empirical yield curves, or, as they are more commonly known, volume-age curves (V.A.C.).

The principle on which empirical yield tables are constructed assumes that forest stands over their life span follow a more or less predictable growing pattern. Therefore, a stand that is 30 years old today will be, in 40 years time, similar to one that is 70 years old now.

The data source consists of all samples that are part of the standing samples data file:

1) Standard inventory samples
2) Permanent growth plots
3) Volume & decay samples

All samples, regardless of their true status, are treated here as temporary inventory samples. For example, if a permanent growth plot has two measurements, each measurement is considered to be an individual sample, independent of the other measurement.

Some of the most important descriptive characteristics that identify a sample are geographical location, which includes region, compartment and sample number, species composition, stand age, and site class.

The volume of the trees on each sample is compiled and the result is expressed in cubic metres per hectare. At present, sample volumes are compiled at eighteen levels; these consist of six diameter at breast height limits, and within them, one or more utilization standards.

During compilation, each sample is assigned a growth stratum, which consists of a growth type group, an age group and a site class. For the construction of a volume-age curve, samples are grouped by growth strata within a given, usually broad, area.

Because at this time, stand density is not a criterion for stratification, a volume-age curve represents a stand with average stocking. However, steps are being taken to include Crown closure and basal area in the growth stratum as measures of stand density. This will make possible the adjustment of average volumes for well stocked and more open stands, provided that the areas to which the volumes are applied have also been classified for Crown closure or basal area. This work is underway.

The geographical areas for which volume-age curves are constructed, change from time to time, depending on Forest Service policy. In the past, the province was divided into seven inventory zones which overlaid administrative units. Accordingly, the two kinds of volume-age curves were: zonal, based on all available samples in a given zone, and local, based on the samples in a management unit. The zonal volume-age curves covered most forest types in a zone, whereas the local curves covered only the major forest types in a unit. Usually this resulted in broader growth types for the local curves than those for the zonal curves.

In 1976, the new forest inventory zones replaced the old zones. The new zone boundaries have been the sole basis for volume-age curve construction although changes are expected in the near future. For example, yield tables and volume-age curves might be constructed for:

1) Administrative forest region (not to be mistaken for inventory region)
2) Timber supply area
3) Local or localized volume-age curves.

In order to provide regional and provincial summaries for this Report, yield tables were constructed for each forest region. These were compiled from the new forest inventory zones using a weighted average procedure to arrive at a uniform regional average. These tables are included in Background Report #1.

Tables showing the land area and volume for each growth type by age class and site class for all Crown forest land were created using the regional yield tables. Figures B-1 and B-2 illustrate the distribution of area and volume by site for the province as a whole. Area and volumes, given by growth type and age class for each site class, are shown in Tables B-5 to B-8. Tables B-5 and B-6 provide data for Crown land and Tables B-7 and B-8 provide data for tree farm licences. All volume figures are based on close utilization standard and are net of decay. Summary tables for each region and detailed tables for each TSA and TFL are in Background Report #1.

Figure B-1

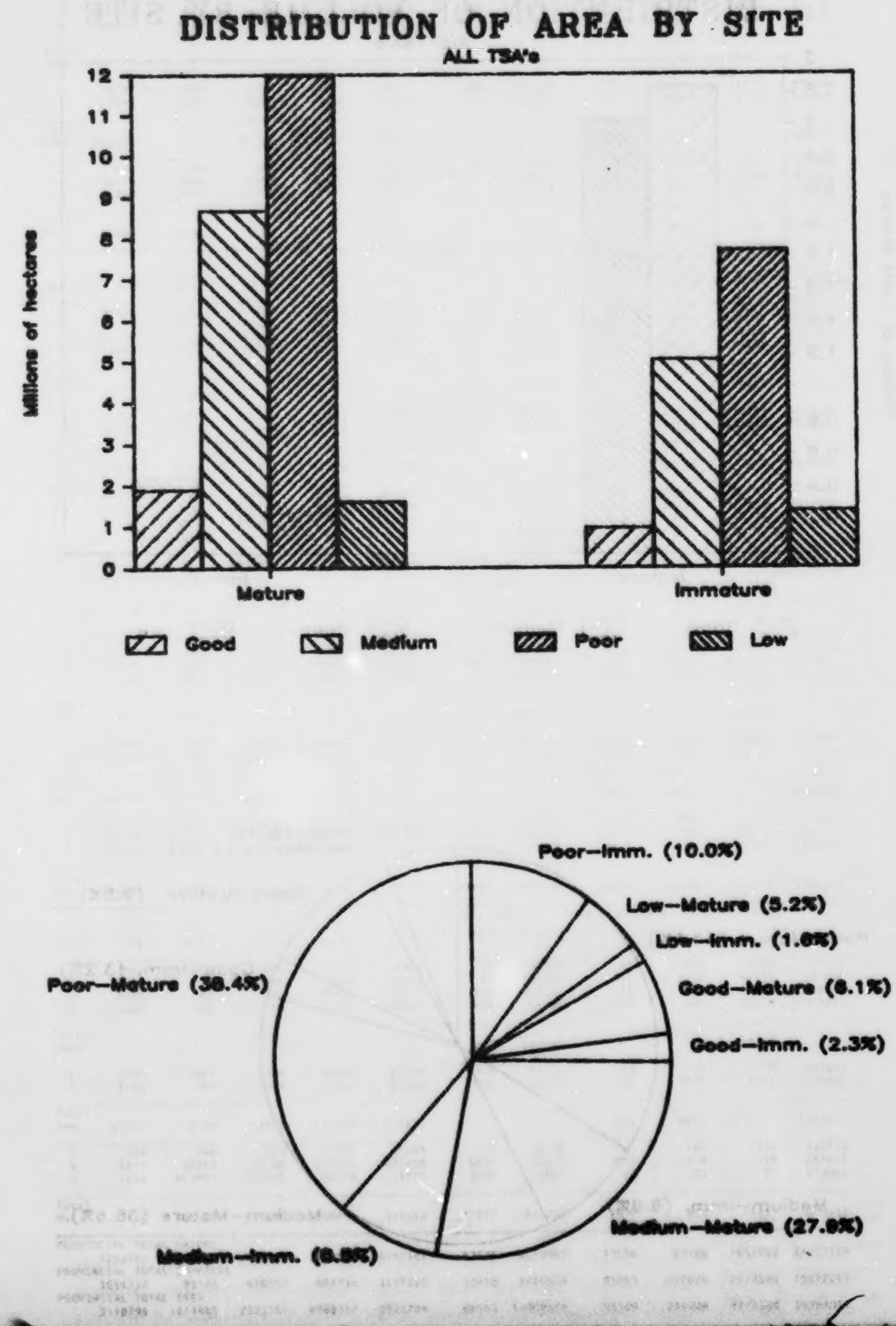

DISTRIBUTION OF AREA BY SITE
ALL TSA's
Millions of hectares
0
1
2
3
4
5
6
7
8
9
10
11
12
Mature
Immature
Good
Medium
Poor
Low
Poor-Imm. (10.0%)
Low-Mature (5.2%)
Low-Imm. (1.6%)
Good-Mature (6.1%)
Good-Imm. (2.3%)
Medium-Mature (27.9%)
Medium-Imm. (8.8%)
Poor-Mature (38.4%)

Figure B-2

DISTRIBUTION OF VOLUME BY SITE

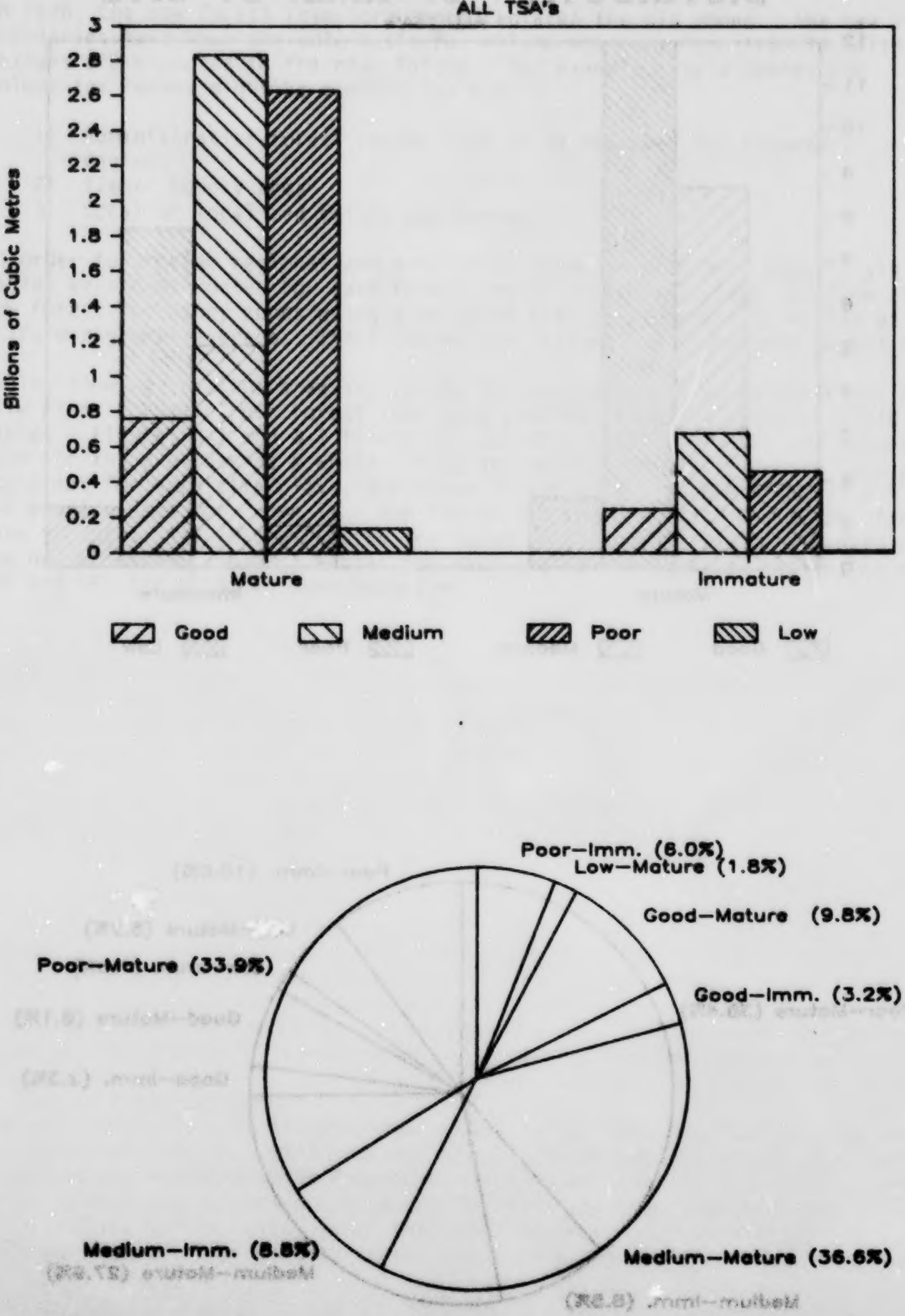


TABLE B-5. PROVINCIAL TSA's Total Area in Hectares by growth type

SITE: GOOD

Age Cl.	1-8	9-11	12-17	18-20	21 26	27	28 31	32	33-34	35 42	Totals
1	12549	2244	4079	14407	89821	40	35505	512	357	3296	163610
2	11551	571	2262	4111	15304	646	17210	820	3700	8909	64984
3	22878	605	4698	1851	11329	1800	60702	2251	10427	6641	123182
4	48930	1127	5780	3117	25082	1575	107771	3634	9237	10174	216427
Total Imm.						3961	221188			29020	
5	76737	1004	4991	4721	85719	881	245130	270	15545	14065	448983
6	75943	230	1495	5736	121893	338	324280	139	5809	4538	540321
Total Imm.	248588	5781	24105	33943	349148			7626	45075		968435
7	32674	387	1275	5076	122670	76	179951	84	4836	6066	353095
8	56278	2556	8809	30400	498362		233227	111	6227	7904	843866
9	11053	12540	24276	8871	58781		928	12	2644	13212	132317
Total Mat.	99997	15483	34360	44347	679813	1215	983436	207	13707	45785	1918350

SITE: MEDIUM Area in Hectares by growth type

Age Cl.	1-8	9-11	12-17	18 20	21-26	27	28 31	32	33 34	35 42	Totals
1	91606	16497	66844	80092	148125	510	157192	581	2509	22815	586771
2	81212	6153	43884	24113	39378	335	258225	1753	29405	162998	647456
3	129366	3108	41860	29065	77953	1775	627256	4161	55892	224067	1194503
4	170407	4217	32991	33368	128959	2830	642539	5454	38915	310592	1370272
Total Imm.						5450	1685212			720472	
5	247785	6854	34796	41751	249617	1696	1096292	2993	28600	493399	2203703
6	151653	11214	27858	47167	374994	974	962968	1260	14045	343744	1935077
Total Imm.	872029	48043	247433	255556	1019026			16122	169166		5038709
7	84056	2802	12821	39276	291904	176	490348	689	6604	87761	1016349
8	376449	50808	178907	510928	1674275	98	671455	6499	24196	39863	3533470
9	56206	158807	415082	243366	297177		14548	233	2479	57141	1245039
Total Mat.	516711	212417	606810	793570	2263356	2936	3235603	7341	33279	1021908	8693931

SITE: POOR Area in Hectares by growth type

Age Cl.	1-8	9-11	12-17	18-20	21-26	27	28 31	32	33 34	35 42	Totals
1	89189	10034	36933	45432	44088	397	278749	811	964	124326	630923
2	78145	5888	27118	59881	66290	582	584240	1405	13029	391926	1228504
3	108397	4252	42636	109414	222535	991	1327144	1999	25763	595307	2438438
4	139438	4911	33959	98651	311093	1314	869979	5990	10979	393497	1869011
Total Imm.						3284	3060112			1505056	
5	179798	2841	25744	125645	417503	2781	1354404	5301	5822	349967	2469806
6	109492	9098	28504	124519	483061	2649	1056490	1581	4310	132376	1952080
Total Imm.	704459	37024	194894	563542	1544570			17087	60867		7690895
7	52751	6893	17846	103434	468473	1987	538364	1490	1990	37137	1230365
8	486778	132578	312864	2082719	1697345	25690	659917	33936	10949	17911	5460679
9	92315	644621	924135	470039	213948	4570	14024	4633	1655	30667	2408607
Total Mat.	631836	784092	1254845	2656192	2379766	37677	3623199	40059	14594	568058	11990318

SITE: LOW Area in Hectares by growth type

Age Cl.	1 8	9 11	12 17	18 20	21-26	27	28 31	32	33 34	35 42	Totals
1	3461	239	569	7687	5496	22	129554	35	116	9058	157036
2	5544	23	1006	10834	13343	44	202207	113	2118	45938	281250
3	5580	360	905	26803	35717	258	332030	37	420	45578	448408
4	5480	643	2926	30688	74529	439	95493	479	524	18664	229865
Total Imm.						763	760164			120038	
5	4400	567	1320	35525	87509	908	96203	167	260	6218	233077
6	5196	442	2089	20202	97806	606	33374	137	1074	5057	166063
Total Imm.	29661	2274	9615	131739	314479			968	4512		1374213
7	704	266	632	17189	85369	479	29776		165	1835	136515
8	4875	52252	19188	235695	275408	8076	56519	1871	610	3120	657614
9	1056	453833	131099	54579	11749	1608	15859	28	33	21	673465
Total Mat.	7515	506351	151719	389463	372546	11677	231731	1899	808	16251	1609960
PROVINCIAL TOTAL MATURE	1256059	1518343	2047734	3883572	5695481	53505	8073969	49506	62388	1652002	24212559
PROVINCIAL TOTAL IMMATURE	1854737	93122	476047	984780	3227223	13458	5726676	41803	279320	2374586	15072252
PROVINCIAL TOTAL AREA	3110796	1611465	2523781	4868352	8922704	66963	13800645	91309	341708	4026588	39284811

TABLE B 6. PROVINCIAL TSA's Total Volume in m³ by growth type (cu less decay)

SITE: GOOD

Age Cl.	1-8	9-11	12-17	18-20	21-26	27	28-31	32	33-34	35-42	Totals
1	25726	57902	24520	97950	52562	2	553154	297	5	19533	831651
2	873623	28440	362168	334383	205479	14493	972763	27986	63834	387212	3270381
3	5349897	47546	1964422	345956	1255615	284765	9473228	252567	1210666	805100	20989762
4	14134607	136285	3466599	1010837	6378468	414497	24718494	912633	2353412	2285969	55811801
Total Imm.						713757	35717639			3497814	
5	25223592	280331	3357644	1587263	28771762	248805	77495830	83076	4805970	3033315	144887586
6	51187581	102425	1068645	2162079	47698027	110346	120236155	48074	1922487	1397559	225933378
Total Imm.	96795016	652929	10243998	5538468	84361913			1324633	10356374		249202541
7	11887475	103862	1063817	2012403	50612137	384590	69220262	29585	1628955	2322961	138706896
8	20034201	1692504	7401431	21131152	212929368		95515972	35553	2154893	2212287	363107361
9	3983718	3527815	21945348	6570372	20813251		382663	3865	920748	180241	58336021
Total Mat.	35905394	5324181	30410596	29713927	284354756	25439	362850890	69003	4712596	9146363	762872296

SITE: MEDIUM Volume in m³ by growth type

Age Cl.	1-8	9-11	12-17	18-20	21-26	27	28-31	32	33-34	35-42	Totals
1	75944	5591	164046	74375	417876	39	36876	2	178	24874	799801
2	2739995	77199	1969575	447311	165862	2354	5907863	12317	227504	3236347	14786327
3	17665619	359963	7334444	2282969	2931620	147394	54003514	298601	4224283	14998083	104246490
4	32124812	911143	10850131	5797558	15569851	569374	102913612	800629	6951693	45459562	221948365
Total Imm.						719161	162061865			63718866	
5	57423048	2587334	16939802	10592244	56803354	451510	219289579	450453	7026079	146475394	518118797
6	40400108	6754833	14588131	13524241	105520416	278621	229228709	252091	3904403	96764027	511215580
Total Imm.	150429526	10696063	51846129	32718698	181408979			1814093	22334140		678627520
7	21719340	1736258	8143180	11789105	87743999	50844	122594500	122220	1943182	27808830	283563458
8	95520529	36287289	122786775	203498753	543596180	12679	187082811	1285181	7561538	10658902	1208290557
9	19033839	115810938	271655905	132559446	109124379	54532	3732199	45926	776539	414728	653208431
Total Mat.	136273708	153834405	402585860	347767304	740464558	848186	761927798	1453327	10281259	282113881	2837550286

SITE: POOR Volume in m³ by growth type

Age Cl.	1-8	9-11	12-17	18-20	21-26	27	28-31	32	33-34	35-42	Totals
1	22558	453	15950	225217	12403	145	47621	8	384	255671	580410
2	893001	15603	267226	954567	578372	6540	3903327	5667	177729	2163505	8965537
3	5118959	150095	2074638	5263283	2874428	15293	44415187	61385	1362090	11415493	72750851
4	13802493	525334	5146972	9410416	14312882	97668	61474407	432257	1124833	25000265	131327527
Total Imm.						119646	109840542			38834934	
5	24052976	701365	6203031	49395890	42322004	378522	134006148	520964	772441	39707579	298060928
6	17916113	3283605	9416972	23371523	69953356	535532	126960114	178852	560926	16047672	269024665
Total Imm.	61806100	4676455	23124789	88620896	138053445			1199133	3998403		462274343
7	9507573	2324819	6652576	22238378	76374010	468342	69997214	178086	384214	4596814	192641946
8	91752178	61388516	138756771	451572000	316662402	6838152	95516932	4072357	2392620	2162457	1171114385
9	20601309	302775286	431329855	139279397	49665947	1150356	2013923	550761	418393	51460	947836687
Total Mat.	121861060	366488621	576739202	613089775	442702359	9370904	428494331	4801124	3115227	63365982	2638028585

SITE: LOW Volume in m³ by growth type

Age Cl.	1-8	9-11	12-17	18-20	21-26	27	28-31	32	33-34	35-42	Totals
1	13				7462		109006				116481
2	1319	5		7775	73410	5	692918	11	196		775639
3	25241	842		230650	180475	2348	1738942	118	1301		2179917
4	112787	11206		2776068	239465	11800	507812	5733	1686		3666557
Total Imm.						14153	3048678			0	
5	158894	23213		1132644	502169	83455	818143	3410	1936		2675864
6	250477	32271	584	988174	826783	43005	684889	4390	2853		2832706
Total Imm.	548731	67537	584	5135311	1829764			13662	7972		10658392
7	49064	26053	3497	1032506	1821029	42576	378882		217		3353424
8	356045	8862563	154658	21283921	14397297	937524	1851707	181201	7525		47152441
9	187103	79791956	2120754	4723100	394833	186501	17125	1500	2438		87425310
Total Mat.	592212	88680572	2278909	27039527	16613159	1253141	2949646	182701	10180		139519947

	1-8	9-11	12-17	18-20	21-26	27	28-31	32	33-34	35-42	Totals
PROVINCIAL TOTAL IMMATURE	309579373	16092984	85215500	132013373	397734101	3856593	311480724	4351521	36696889	408851614	1402852672
PROVINCIAL TOTAL MATURE	294632374	614327779	1012014567	1017610533	1484134832	9766945	1556222665	6426155	18119262	354626226	6367881238
PROVINCIAL TOTAL VOLUME	604211747	630420763	1097230067	1149623906	1881868933	13623538	1867703389	10777676	54816151	763477840	7770733910

Table B-7. TREE FARM LICENCE SUMMARY: Area in Hectares

TFL.No.	Plan Date	Total Area	Prod. Area	N.P.	Mature Productive G	M	P	L	Total	Immature Productive G	M	P	L	Total
REGION: CARIBOO														
5	1979	34334	32875	1459	2277	6852	4788	985	14902	2426	11918	3142	485	17971
REGION: KAMLOOPS														
9	1978	79193	73553	5640	12580	22903	5794		41277	2495	22023	4354	46	28918
15	1979	48196	44699	3497	883	10649	2994		14526	1290	4777	13116		19183
16	1979	52039	48443	3596	4417	15404	4324		24145	2743	16575	2485	109	21912
18	1982	74990	67711	7279	13259	16819	4342		34420	5460	20808	4469		30737
32	1980	13667	12874	793	638	3969	977		5584	729	5100	588		6417
33	1982	8458	8075	383	1288	1877	1179		4344	296	1914	797		3007
35	1982	39451	36869	2582	5717	11104	1899		18720	3158	9360	3578		16096
Total		315994	292224	23770	38782	82725	21509		143016	16171	80557	29387	155	126270
REGION: NELSON														
3	1979	79687	43992	35695	2165	8659	7557		18381	5729	14375	3760		23864
8	1979	77545	71696	5849	12725	19224	1514		33463	11374	20867	952		33193
13	1983	37113	22146	14967	1073	2935	1183	10	5201	3774	9373	2261		15408
14	1980	139513	51237	88276	2648	9483	6548	617	19296	1929	13269	10947	1098	27243
23	1979	1006437	572887	433550	78592	196964	55024	3710	334290	47822	119850	33481	2258	203411
Total		1340295	761958	578337	97203	151855	71826	4337	410631	70628	177734	51401	3356	303119
REGION: PRINCE GEORGE														
30	1981	181277	158205	23072	45910	49838	16369		112117	18834	10153	1781		30768
42	1983	49576	44729	4847	13290	15765	4049		33104	1622	5021	2727		9370
Total		230853	202934	27919	59200	65603	20418		145221	20456	15174	4508		40138
REGION: PRINCE RUPERT COAST														
1	1976	1010263	484261	526002	7423	127870	242341		377634	9803	73970	10099		93872
2	1979	27522	26057	1465	505	4406	5171	4959	15041	851	7719	1730	155	10455
24	1979	112470	76611	35859	1984	21122	27741	4870	55717	2006	15219	3069	600	20894
39	1981	113331	96345	16986	2652	28248	37101	6512	74513	1847	14015	2826	552	19240
41	1979	1019989	271938	748051	13692	105715	70773	50990	241170	1367	10492	6300	3405	21564
Total		2283575	955212	1328363	26256	287361	383127	67331	689562	15874	121415	24024	4712	166025
REGION: VANCOUVER														
2	1979	189833	175246	14587	1338	7069	13045	16110	37562	11822	54689	47525	14201	128237
6	1980	170025	146844	23181	2035	30433	34998	13623	81089	3907	37858	14059	4002	59826
7	1980	78423	72305	6118	908	13571	15607	6075	36161	2121	20558	7635	2173	32487
10	1978	231116	61823	169293	1382	15933	16851	13605	47771	1416	7495	3988	211	13110
12	1980	9479	8897	582	61	691	951	809	2512	903	3359	1286	620	6168
19	1980	192402	114888	77514	1361	36421	37694	3200	78676	1894	28998	3485	169	34546
20	1983	195758	170367	25391	2512	37562	43196	16814	100084	2900	28109	10439	2972	44420
21	1978	258942	223454	35488	3571	53394	61404	23902	142271	4470	43315	16086	4579	68450
25	1979	454457	171466	282991	2771	41429	47644	18545	110389	9663	28256	6620		44539
26	1982	8742	7560	1182	243	761			1004		5483	389		5872
37	1979	188440	131149	57291	2101	31414	36126	14062	83703	2721	26373	9794	2788	41676
38	1977	219006	52426	166580	1043	1588	17927	6978	27536	349	3386	1257	358	5350
39	1981	608148	371699	236449	6014	89927	103418	40255	239614	7890	76459	28395	8083	120827
45	1983	286975	60454	226521	1176	17580	20217	7870	46843	801	7759	2882	820	12262
46	1983	181456	168229	13227	2459	36760	42275	16455	97949	3342	32385	12027	3424	51178
GVWD	1980	61134	40174	20960	616	9206	10587	4121	24530	609	5908	2194	625	9336
Total		3334336	1976981	1357355	29591	423739	501940	202424	1157694	54808	410390	168061	45025	678284
PROVINCIAL TOTAL		7537387	4221687	3315700	253309	1103545	1003608	275077	2635539	180363	817188	280523	53733	1331807

Table B-8. TREE FARM LICENCE SUMMARY Mature Volume in m^3 by Growth Type (cu less decay)

TFL#	1-8	9-11	12 16	18-20	21-26	27	28-30	32	33-34	35-42	Total
REGION: CARIBOO											
5	1795744			438625	1463379		1154303				
Total	1795744			438625	1463379		1154303				4852051
REGION: KAMLOOPS											
9	1440830	44206		1469817	3796142	934	5424448	41493	18537		12236407
15	604028			188325	495458		1311664	49049	346197	2336	2997057
16	1046964			334593	666628		4114795	16864		14977	6194821
18	350444	251630	50655	1550760	5056185	2210	3073775			95689	10431348
32	197536	30904		323288	439655		418709	9370		96	1419558
33	523123	454770	327204	207316	181226	64366	16317		37411	27518	1839251
35	867386	9807		594397	1724555		1815569			54496	5066210
Total	5030311	791317	377859	4668496	12359849	67510	16175277	116776	402145	195112	40184652
REGION: NELSON											
3	203098	756361	934370	1587018	2092139	151306	217670		108377	5475	6055814
8	1416435	75000		560700	1400005	19348	2742504	15790	893146	22342	7145270
13	137994	290021	24649	360529	573252	106753	213756		18852	2112	1727918
14	217769	8163	11185	1313578	2095114	370018	1739800		29101		5784720
23	4105688	20770435	29237087	8278770	17749509	1808059	1306653	36331	1052877	147101	84492510
Total	6080984	21899980	30207291	12100595	23910019	2455476	6220383	52121	2102353	177030	105206232
REGION: PRINCE GEORGE											
30	798991	84857	449354	7621295	19334596		1253728			732240	30275061
42	1008300			786900	3504500		3279500			885100	9464300
Total	1807291	84857	449354	8408195	22839096		4533228			1617340	39739361
REGION: PRINCE RUPERT COAST											
1		298941	27169250	9408640	5171534		2034027			1099600	45181992
2		3311967	4032152		1226816		25211			21407	8617553
24		12579900	19962900		6908900		64300				39516000
39		43325000	57869000		17768000		456000			171000	119589000
41	137964	15641459	70971125	39420979	5252154		66939			702821	132193441
Total	137964	75157267	180004427	48829619	36327404		2646477			1994828	345097986
REGION: VANCOUVER											
2	141124	3505824	8529761	4502976							16679685
6	848800	22308100	41690000	15521600	1977200						82345700
7	1487320	5407800	12139352	7948856		53448				105224	27142000
10	3051820	7087297	9873171	7432228	570216		30111			132247	28177082
12	109458	450950	735639	212993	30919						1539959
19	5170610	14562680	24333260	14098800	317590	257830	71540			42350	58854660
20	4223000	31362000	23437000	13063000	554000	505000	163000			620000	73927000
21	11940000	31510000	46791000	23689000	554000	609000	23000			180000	115296000
25	760400	20370600	26714400	13413700	1945700	34900	107200				63346900
26	121714	94372	303251	40389		4108					563834
37	9670753	4808145	56399957	3230105							74188960
38	3441542	6592062	7887539	6514183	32176	13768	11236			15653	24508159
VWD	1726954	4141965	6476078	4584774	34062	10219	6812			50242	17031106
39	3598000	31812000	64765000	37083000	3777000	99000	88000			203000	141425000
45	1593972	3108082	12385146	5982111	655197	20640	5203			151169	23901520
46	3591273	15589332	25134735	11127103	364684		205395				55932522
Total	51476740	202711209	367595289	168444810	10812744	1607913	711497			1499885	804860087
PROVINCIAL TOTAL	66329034	300644630	578634220	242890340	107712491	4130899	31441165	168897	2504498	5484195	1339940369

CHAPTER B3

PROJECTIONS OF FUTURE TIMBER RESOURCES

Knowing the future composition of the forest is essential for ensuring proper resource planning. Industry needs to know what the species composition and size of timber will be in order to make decisions on investments in harvesting and milling, and government needs this information in order to determine the allowable cut and prescribe harvesting and silvicultural practices. To provide this information, the Ministry of Forests used the forest planning model "Multiple Use Sustained Yield Calculation" to project the shape of the growing stock over the next 100 years.

Although this chapter starts from the same data base as the previous chapters, the data are used to portray a different aspect of the forest resource and are not directly comparable.

In order to illustrate the effects of different management practices on the gross forest land base, the areas on which timber harvesting could occur were separated out and defined as the operable or net productive land base. No harvesting was assumed to take place on the inoperable areas whereas current harvesting and management practices were assumed for the net land area. The growing stock for both operable and inoperable areas was combined to give a single growing stock projection for the gross land base.

To determine the net land base the gross land base was reduced by subtracting land alienations, nonforested lands, deciduous stands, low sites, environmentally sensitive areas and problem forest types. The unsalvaged losses, that is the timber volumes expected to be lost to fire, pests, windthrow, slides and avalanches, are accounted for by adding an assumed volume to the harvest schedule.

Assumptions used in the model are as follows:

1. The current harvest profile will be maintained.
2. Current management practices will continue.
3. Basic forestry standards will be achieved.
4. Utilization standards for the interior units will be 17.5 cm diameter at breast height (dbh) for all species except lodgepole pine which will be utilized to 12.5 cm dbh. In all of the Vancouver Region, the Queen Charlotte TSA and the Hecate and Kitimat blocks of the North Coast TSA, utilization level is 22.5 cm dbh.

Other assumptions, such as cutting priority because of pest infestation, species preference, and logging systems were applied to specific TSAs.

Figure B-3 illustrates the projected areas by age class for the next ten decades for the entire province. In Figures B-3 to B-7, the nine inventory age classes have been combined into five groups as shown in the legend under each bar graph. The first bar graph, for the net land base, shows that the area in age classes one and two will increase until the fifth decade, then remain constant. The area in age classes three and four will decrease slightly over the same period, then increase substantially over the next five decades. Age classes five and six are projected to decline slightly in area over the forecast period and the area in age class seven will increase slightly. The area in age classes eight and nine is where the greatest decline occurs. This is to be expected as it is in these age classes where the major part of timber harvesting occurs. On the gross land base the changes in distribution of age classes are not apparent. The increase in old growth on the unlogged portion of the land base compensates for the decrease due to logging. This projection of the distribution of age classes indicates that there will continue to be large areas of mature and immature forest in the province.

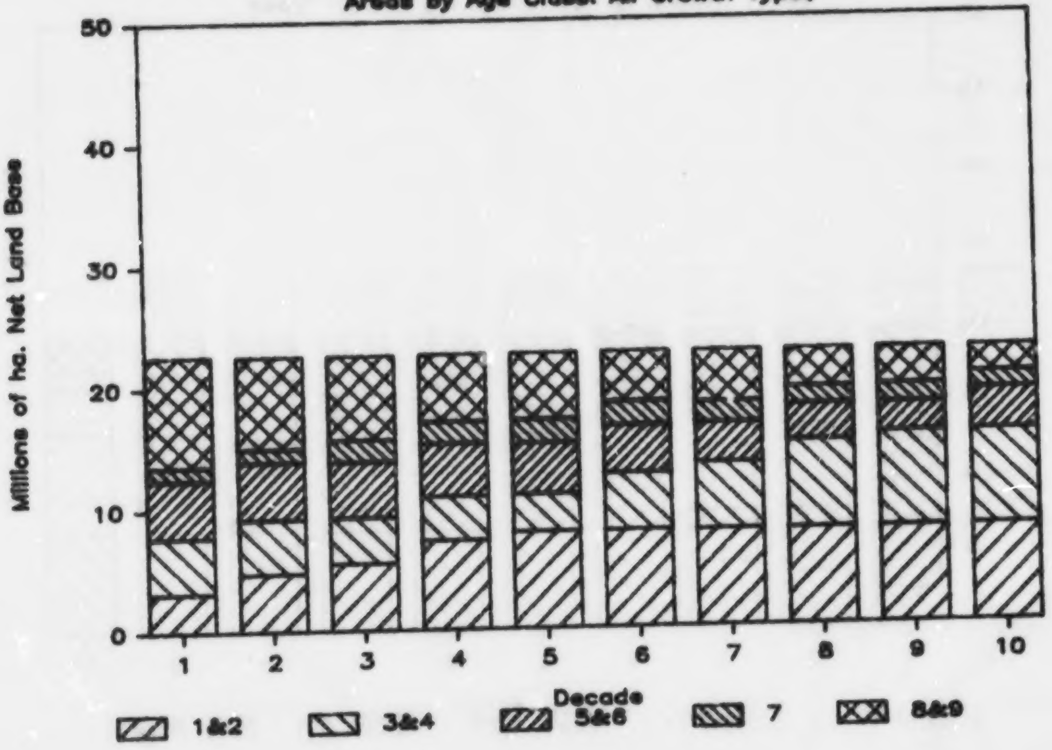
In all regions the average age of the stands on the net operable land base is decreasing and tending toward a forest having an equal area by age class below age 100. On the inoperable land base, large areas of stands greater than 141 years of age are retained. At the end of the 10th decade about 84% of the net land base area is occupied by class 6 or younger stands whereas at present these age classes only occupy 55%. The distribution of growth types on the net land base is similar to that on the gross land base. But, because a large portion of the growing stock on the gross land base is not available for harvest, the proportion of area in the older age class is greater.

This trend is particularly evident in the Prince George Northeast (Figure B-6) where, because of the large areas of immature deciduous and pine stands in remote areas, there is a large area in age class 8 and 9. By the tenth decade, these areas occupy 40% of the gross land base area, whereas at present they occupy only about 10% of the gross land base area.

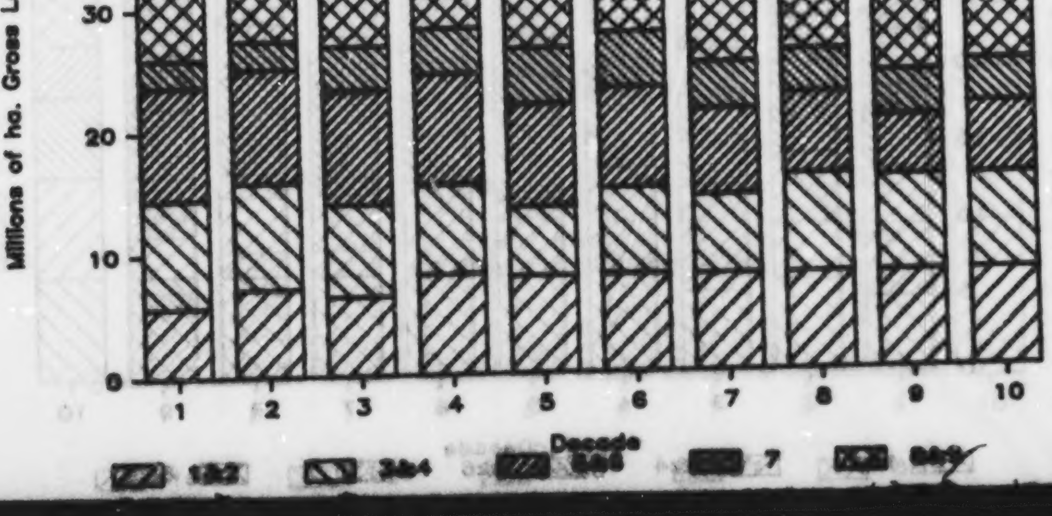
In the Prince Rupert Coast region (Figure B-7), the trend is similar on the net operable land base to that in other regions. At the end of the tenth decade there will be a fairly even distribution of age up to 100 years on 90% of the net land base area and only 10% in age 100 and above. However, on the gross land base the area in stands older than 250 years is by far the most dominant, covering 77% of the gross land base in TSAs.

As expected, the total volume on the net operable land base is declining in all regions (Figures B-8 and B-9). This is the result of harvesting the over-mature old growth forests and replacing them with younger, smaller volume stands. The volume on the inoperable base outside the harvestable area is either remaining constant as in the Prince Rupert Coast or increasing as in the Prince George Northeast (Figure B-10).

Figure B-3

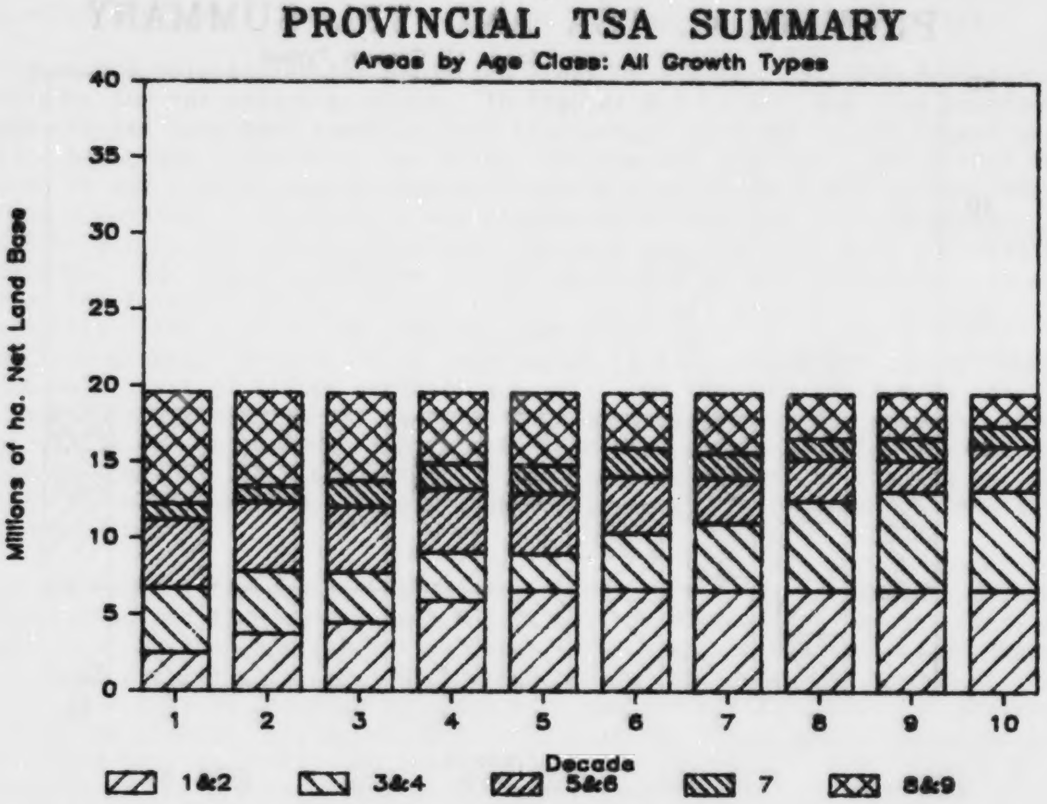

PROVINCIAL TSA AND TFL SUMMARY

Areas by Age Class: All Growth Types


PROVINCIAL TSA AND TFL SUMMARY

Areas by Age Class: All Growth Types

Figure B-4


PROVINCIAL TSA SUMMARY
Areas by Age Class: All Growth Types
Millions of ha. Net Land Base
0
5
10
15
20
25
30
35
40
1
2
3
4
5
6
7
8
9
10
Decade
1&2
3&4
5&6
7
8&9

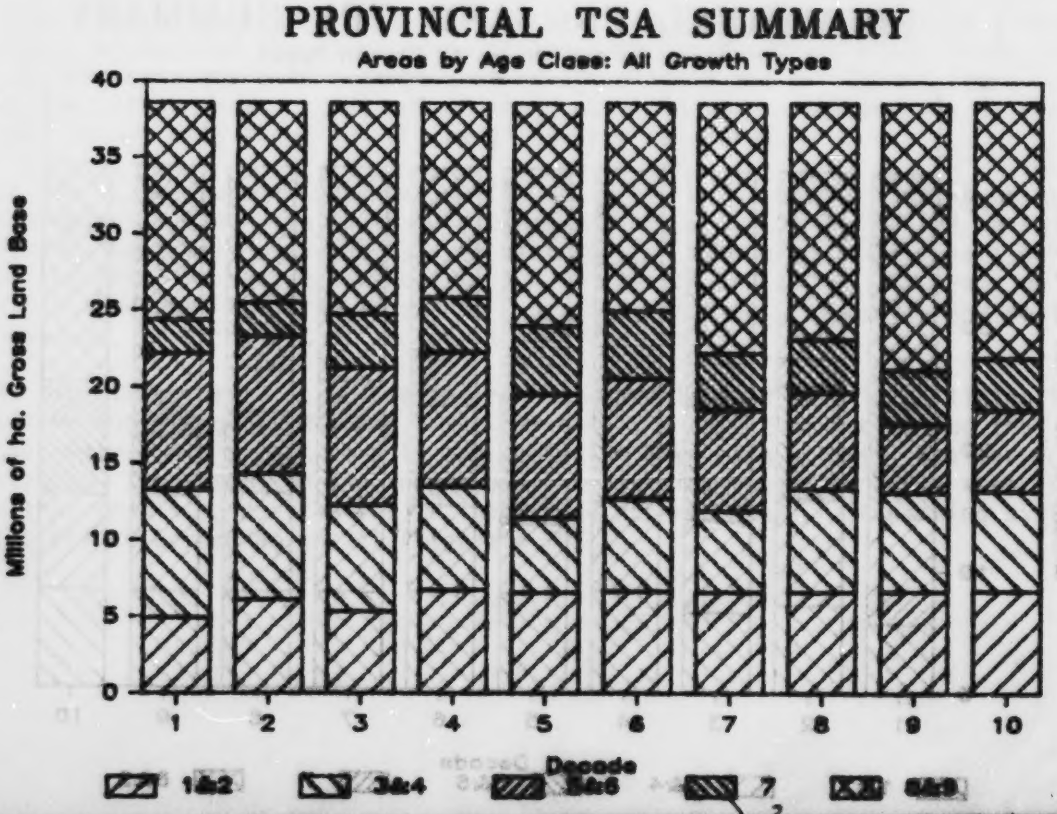
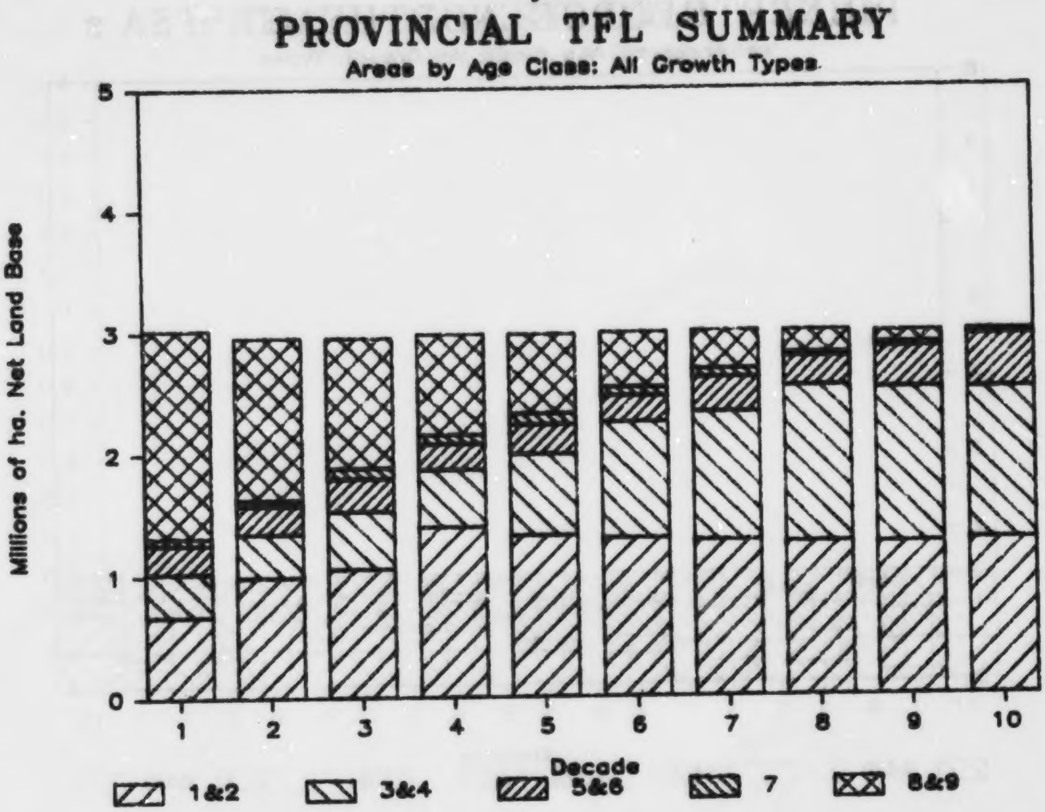

PROVINCIAL TSA SUMMARY
Areas by Age Class: All Growth Types
Millions of ha. Gross Land Base
0
5
10
15
20
25
30
35
40
1
2
3
4
5
6
7
8
9
10
Decade
1&2
3&4
5&6
7
8&9

Figure B-5


PROVINCIAL TFL SUMMARY
Areas by Age Class: All Growth Types
Millions of ha. Net Land Base
0
1
2
3
4
5
1
2
3
4
5
6
7
8
9
10
Decade
1&2
3&4
5&6
7
8&9

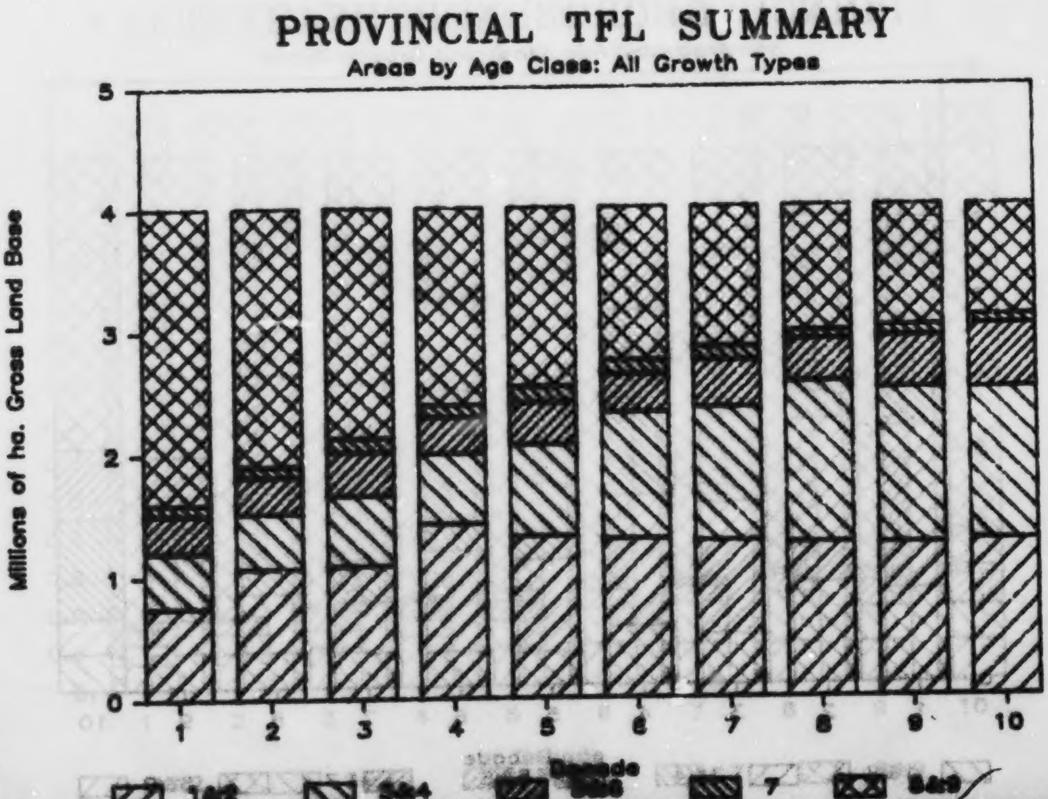

PROVINCIAL TFL SUMMARY
Areas by Age Class: All Growth Types
Millions of ha. Gross Land Base
0
1
2
3
4
5
1
2
3
4
5
6
7
8
9
10
Decade
1&2
3&4
5&6
7
8&9

Figure B-6

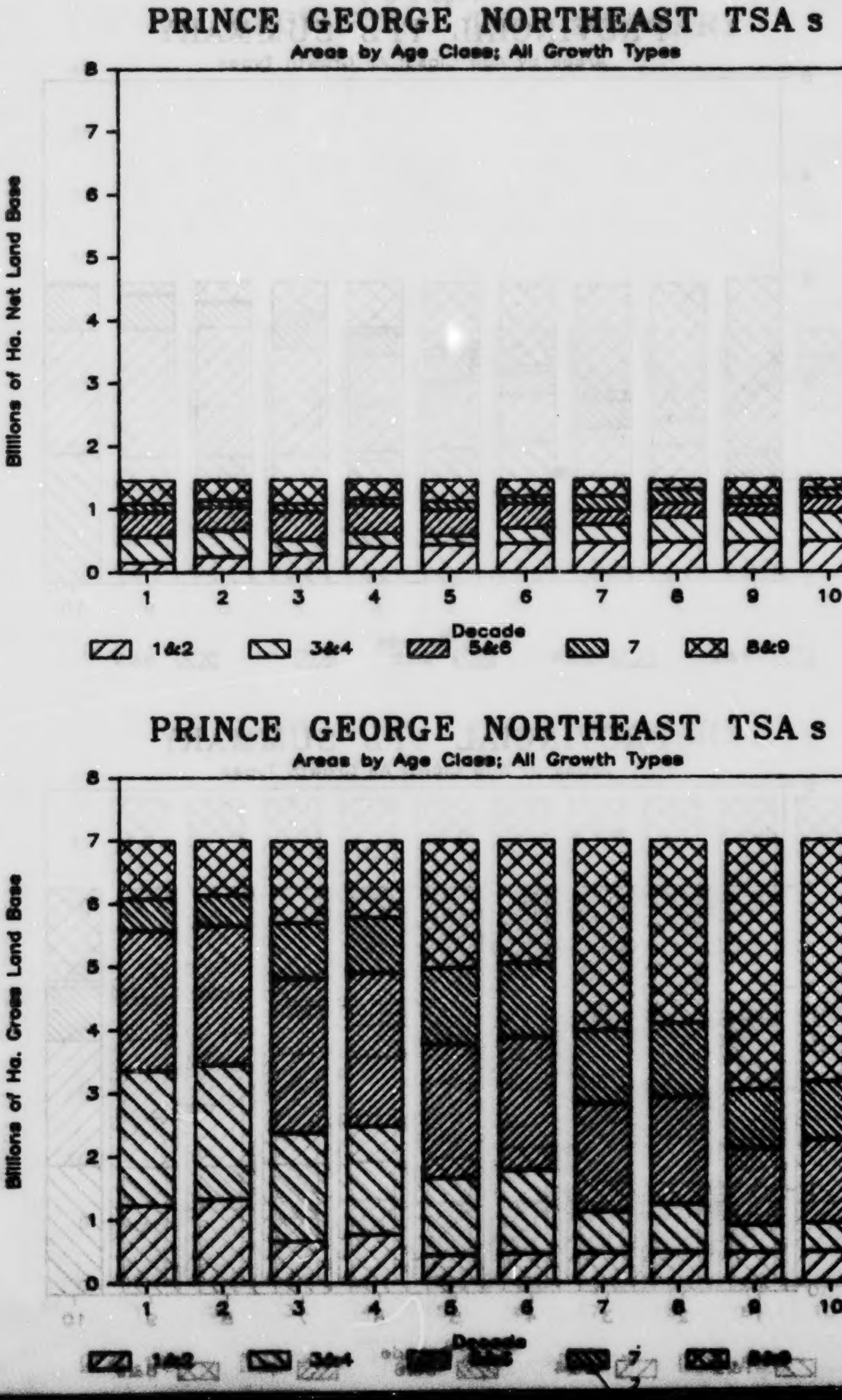
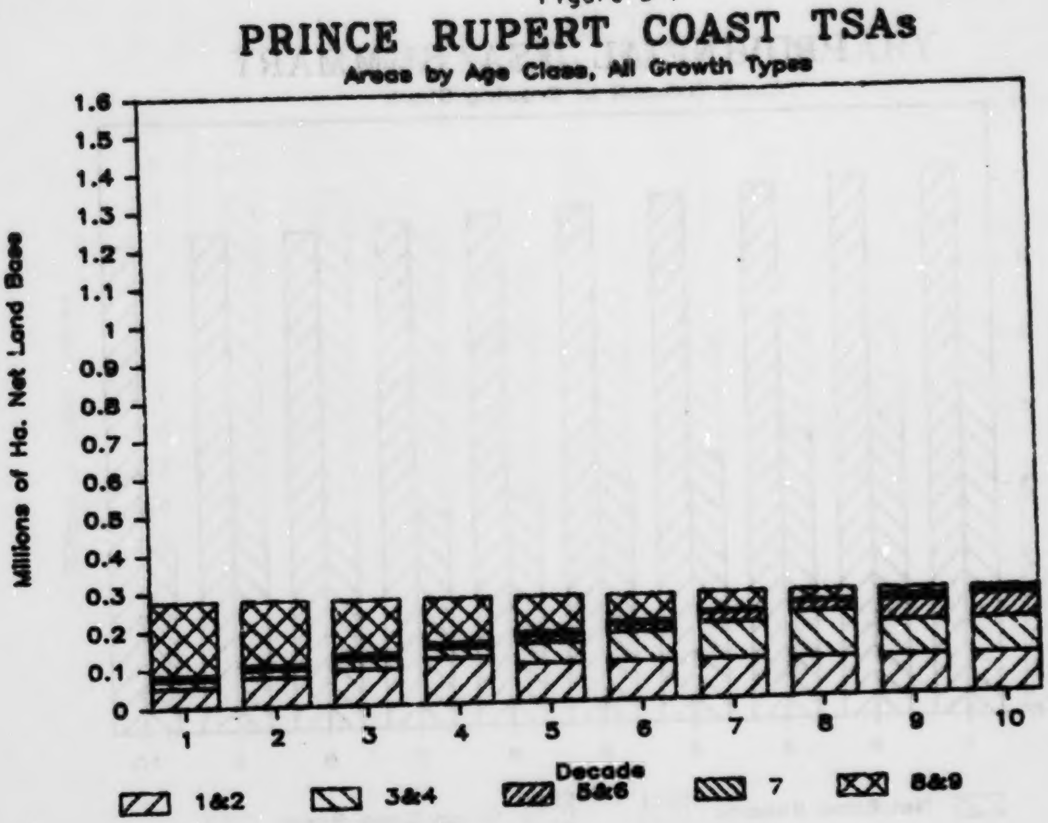

PRINCE GEORGE NORTHEAST TSA s
Areas by Age Class; All Growth Types
Billions of Ha. Net Land Base
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
8
9
10
Decade
1&2
3&4
5&6
7
8&9
PRINCE GEORGE NORTHEAST TSA s
Areas by Age Class; All Growth Types
Billions of Ha. Gross Land Base
0
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
8
9
10
Decade
1&2
3&4
5&6
7
8&9

Figure B-7


PRINCE RUPERT COAST TSAs
Areas by Age Class, All Growth Types
Millions of Ha. Net Land Base
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1
2
3
4
5
6
7
8
9
10
Decade
1&2
3&4
5&6
7
8&9

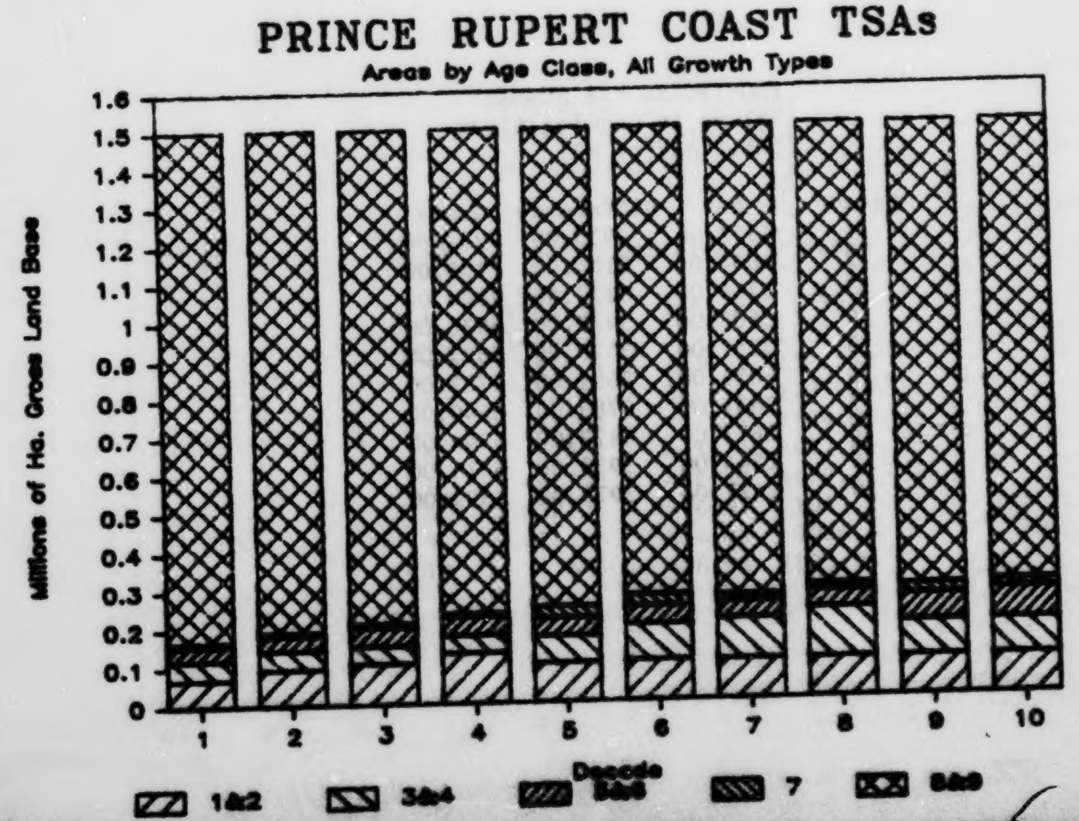
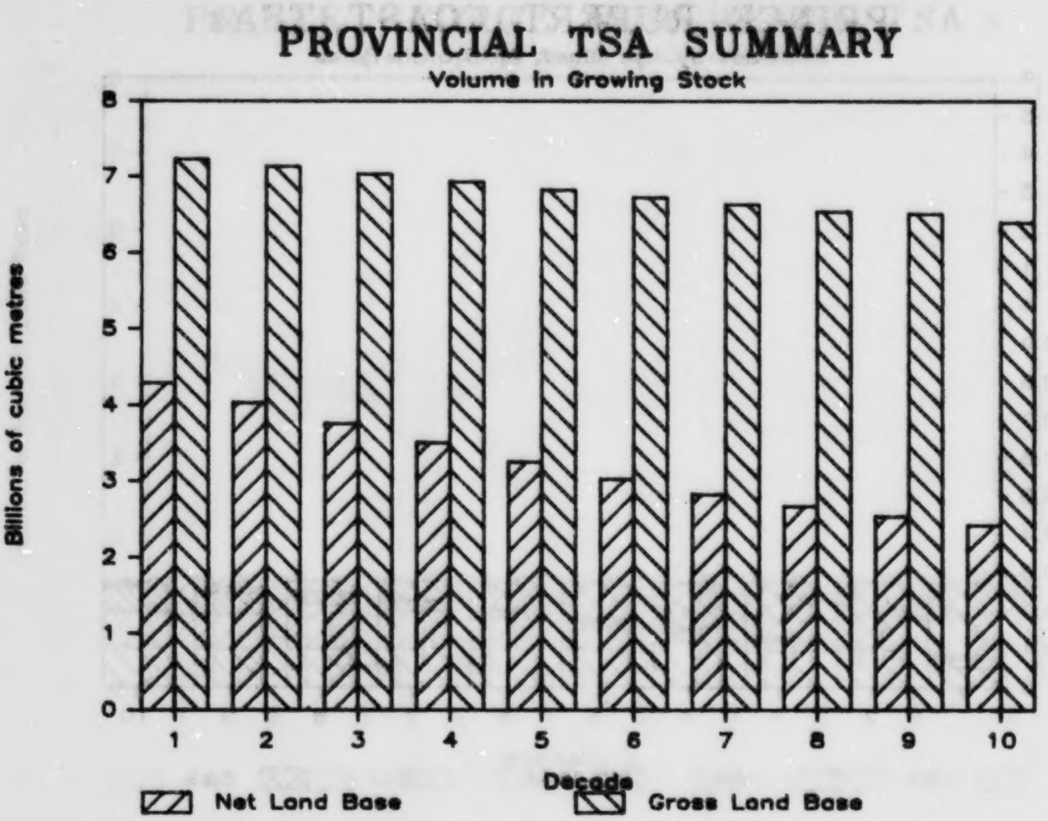

PRINCE RUPERT COAST TSAs
Areas by Age Class, All Growth Types
Millions of Ha. Gross Land Base
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1
2
3
4
5
6
7
8
9
10
Decade
1&2
3&4
5&6
7
8&9

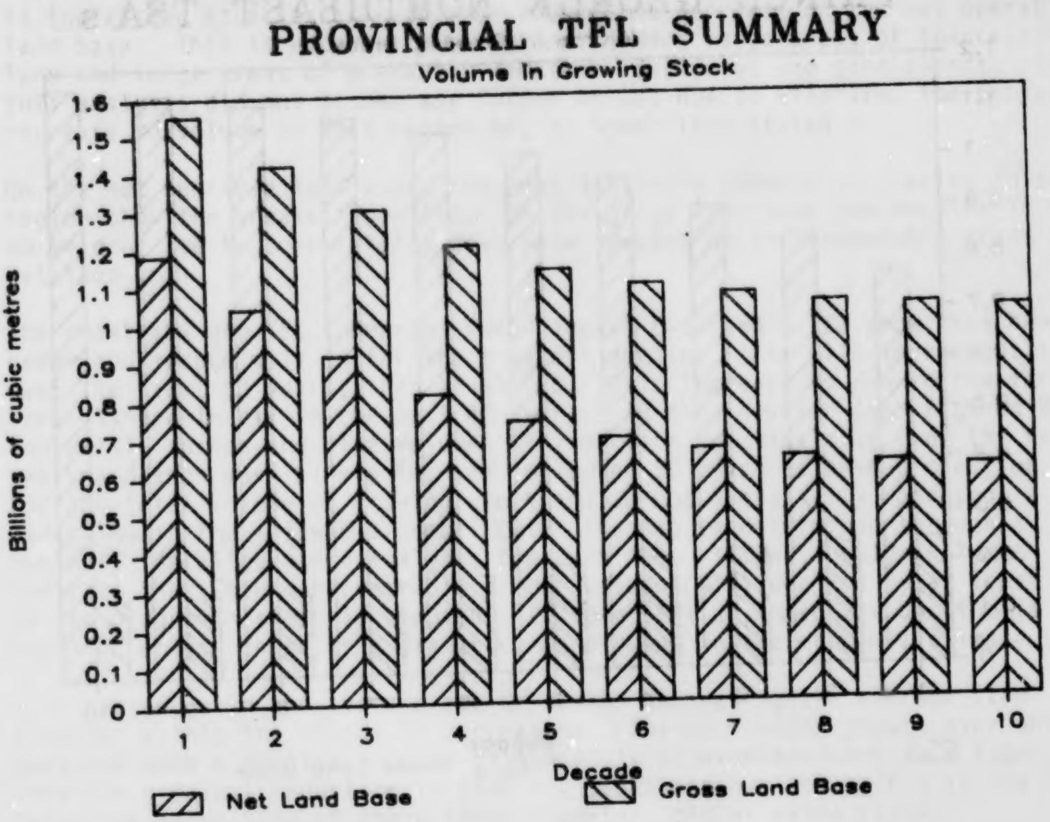
Figure B-8



PROVINCIAL TSA SUMMARY
Volume in Growing Stock
(millions of m3)

Decade	Net	Difference	Gross
1	4302.00	2935.00	7237.00
2	4034.00	3104.00	7138.00
3	3764.00	3277.00	7040.00
4	3508.00	3429.00	6936.00
5	3257.00	3570.00	6827.00
6	3034.00	3691.00	6727.00
7	2831.00	3789.00	6640.00
8	2672.00	3872.00	6544.00
9	2544.00	3933.00	6514.00
10	2427.00	3973.00	6399.00

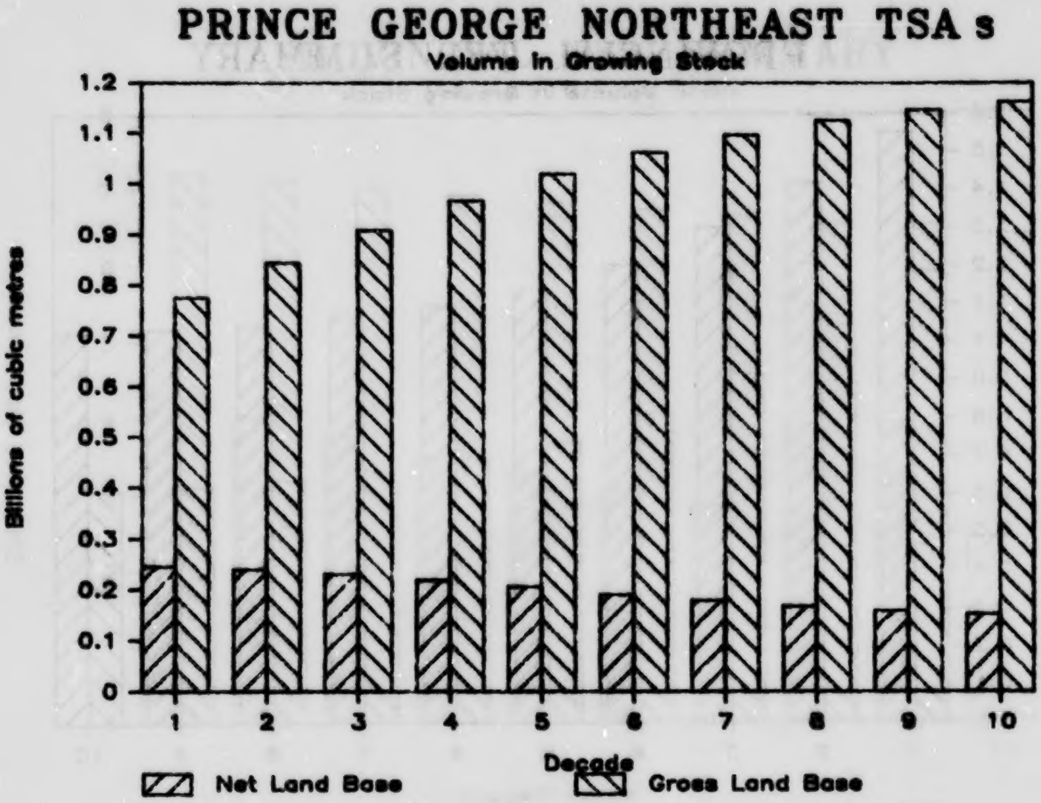
Figure B-9


PROVINCIAL TFL SUMMARY
Volume in Growing Stock

PROVINCIAL TFL SUMMARY
Volume in Growing Stock
(millions of m3)

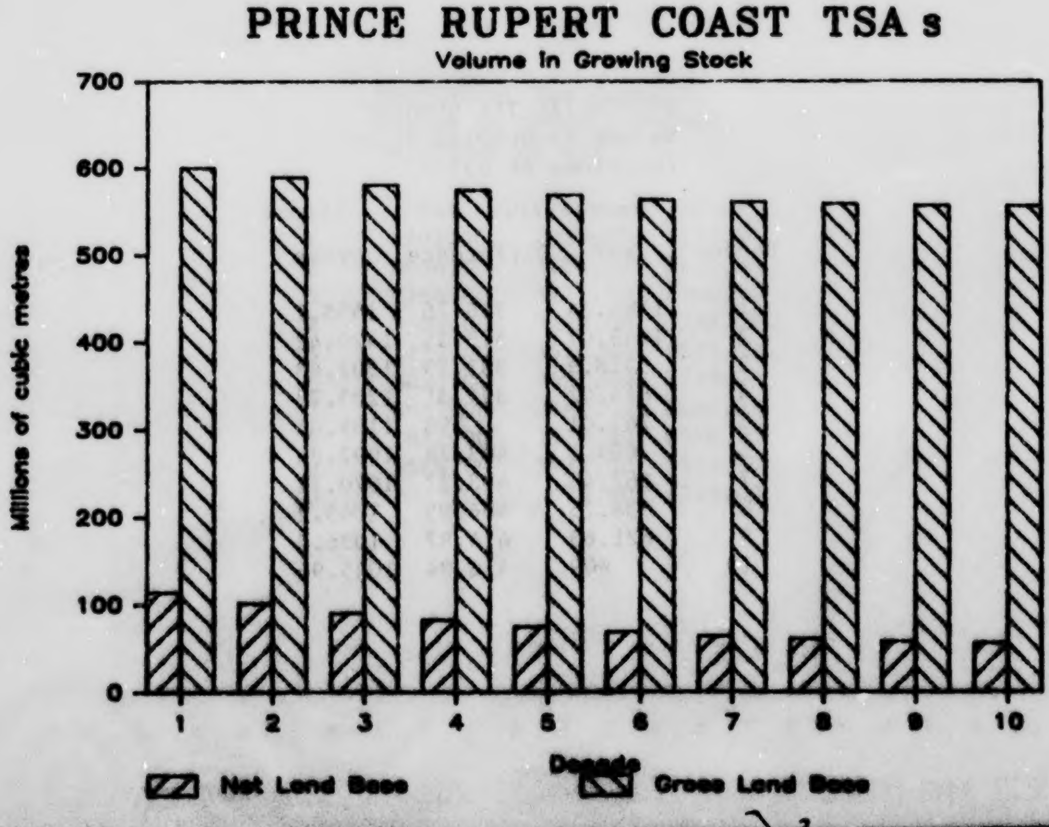
Decade	Net	Difference	Gross
1	1188.34	366.76	1555.1
2	1045.07	375.35	1420.42
3	918.9	383.73	1302.63
4	814.42	391.31	1205.73
5	741.01	398	1139.01
6	694.1	403.74	1097.84
7	662.45	408.27	1070.72
8	638.25	406.95	1045.2
9	621.63	414.87	1036.5
10	609	416.94	1025.94

Figure B-10



PRINCE GEORGE NORTHEAST TSA s

Volume in Growing Stock



PRINCE RUPERT COAST TSA s

Volume in Growing Stock

The volume increase on the inoperable land base in the Prince George Northeast is increasing at a faster rate than the volume decrease on the net operable land base. This is because this region includes large areas of inaccessible land and large areas of presently immature, deciduous and pine stands. (Since this analysis did not assume any future losses due to wildfire, the projected increase in volume in this region may be lower than stated.)

On the net operable land base, the most desirable commercial species in each region show the greatest decline. On the gross land base the decline is not so evident due to commercially desirable species on the inoperable areas being retained.

The coast TSA and TFL summaries (see Figures B-11 and B-12) show that hemlock, cedar and spruce will suffer the greatest decline. Fir will increase slightly over the first 50 years, then level off. This increase is due to the large area planted in fir in the past 40 years. In the interior (see Figures B-13 and B-14), spruce and pine volumes will decline substantially over the next 50 years and then more slowly for the following 50 years. These projection are for the total volume of growing stock and do not necessarily represent a reduction in the allowable annual cut. The AAC is determined through a periodic, detailed yield analysis for each TSA. Timber supply analyses indicate that future harvestable timber volumes will decline by at least 10% as the oldgrowth stock is removed. In some TSAs an immediate decline is expected unless there is a dramatic improvement in the economic climate.

As expected, with the average age of timber decreasing the average stem diameter within the stands is decreasing. The only major growth type which does not show a decline in size is lodgepole pine. The two growth types which show the greatest reduction in size are cedar and hemlock. This is due to the intensive harvesting of these large diameter, higher value stands.

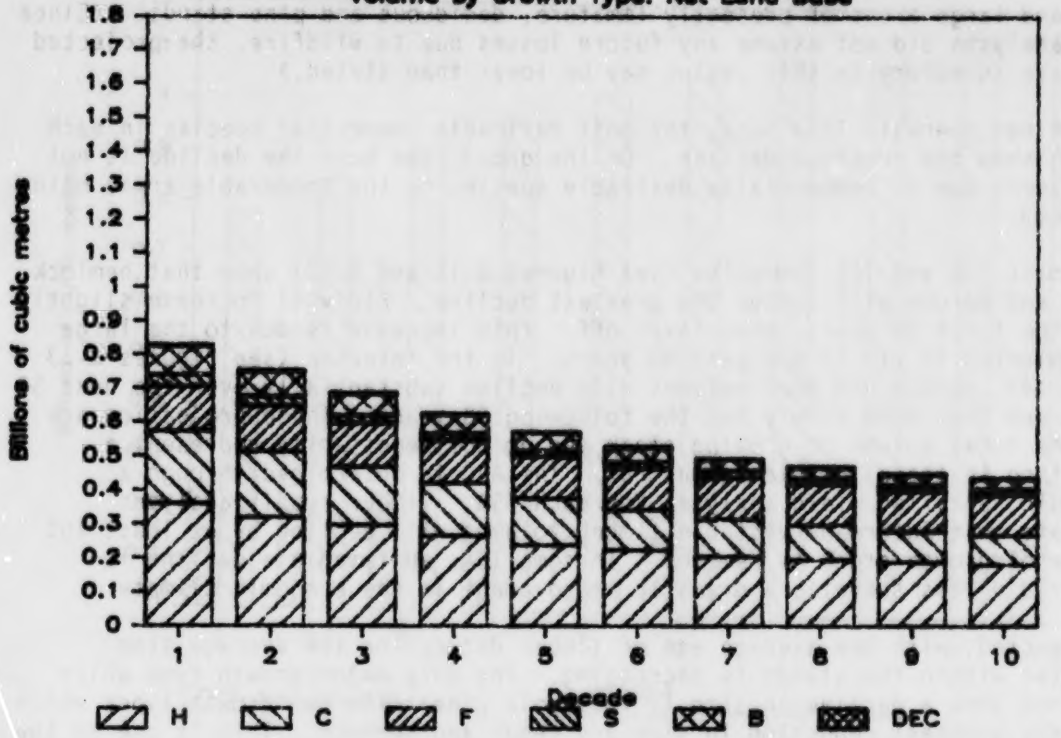
Spruce and balsam growth types are also forecast to show a reduction in average stem diameter over the next 50 to 60 years. In the Vancouver region the average stem diameter at breast height is about 46 cm for spruce and 43 cm for balsam. After 60 years the diameter is projected to be about 35 cm for spruce and 32 cm for balsam, a drop of 11 cm. In the interior after 60 years, the average stem diameter is projected to drop about 4 to 6 cm for the same species. Table B-9 shows projected average diameter of all stems in the growth types for the next 10 decades.

While the average diameter of all stems in stands is decreasing as is the diameter of future harvestable age timber although volume at culmination age may be greater. With better planting stock and more intensive silviculture there will be less variation in the diameter of the logs sent to the processing plants. Table B-10 shows the average diameter for the major commercial species at minimum harvest age.

Figure B-11

COAST RESOURCE ANALYSIS REGIONS (TSAs)

Volume by Growth Type: Net Land Base



COAST RESOURCE ANALYSIS REGIONS (TSAs)

Volume by Growth Type: Gross Land Base

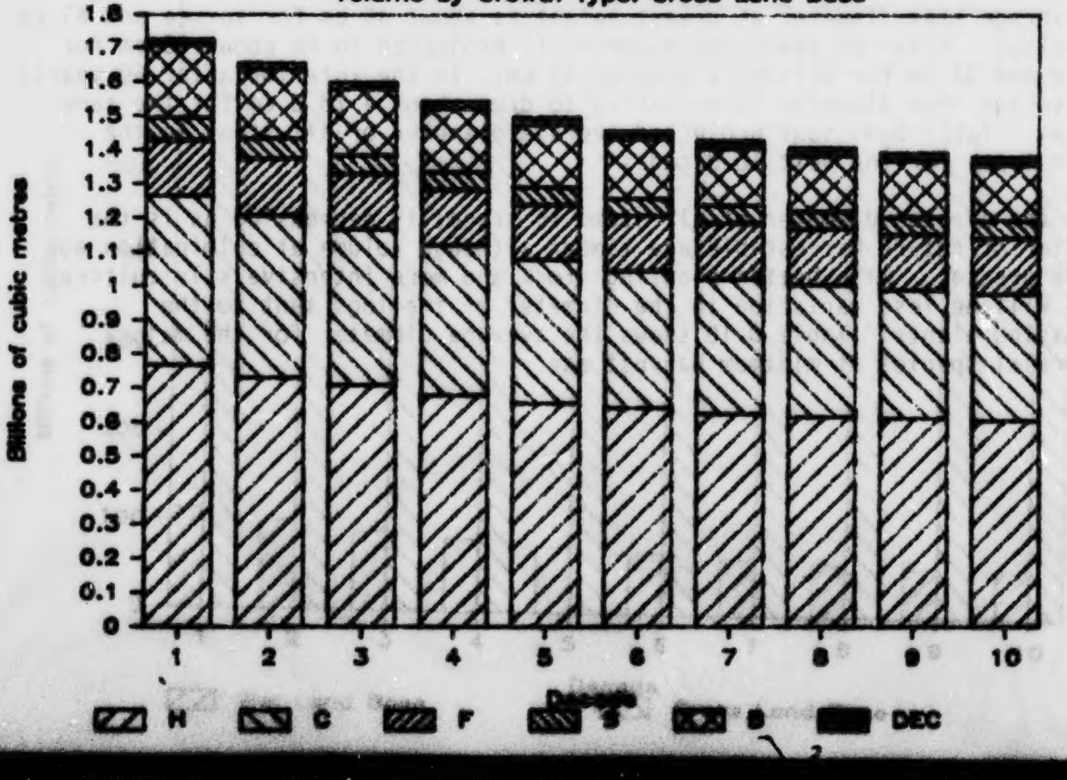
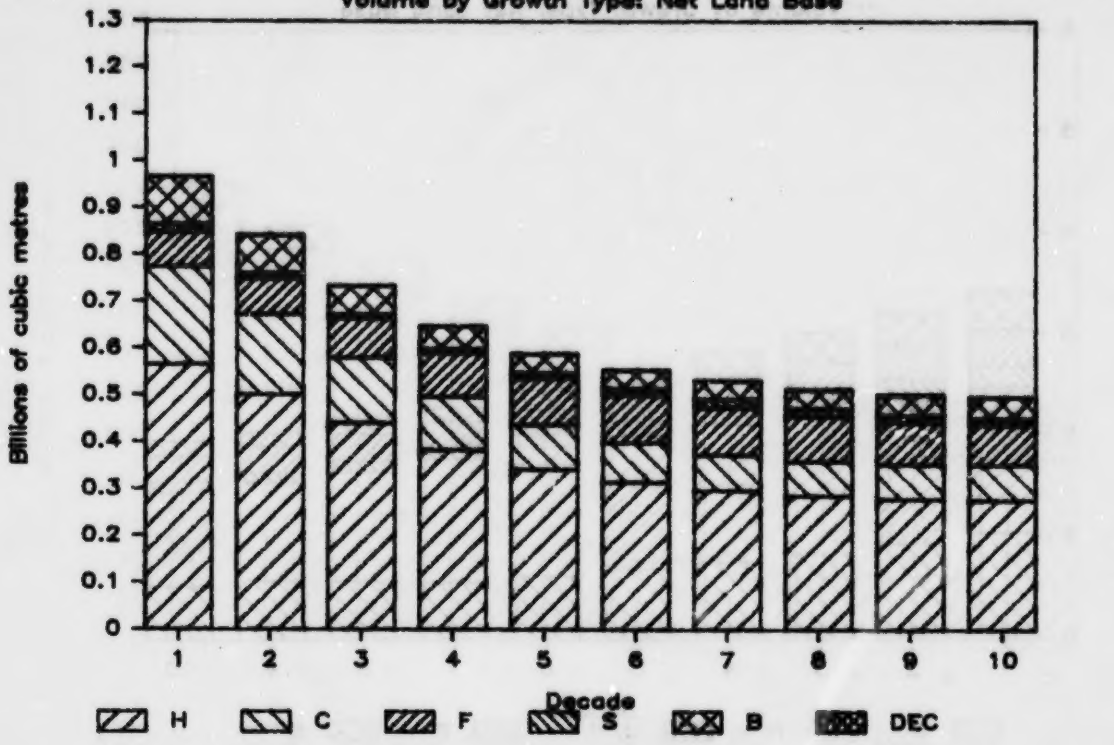
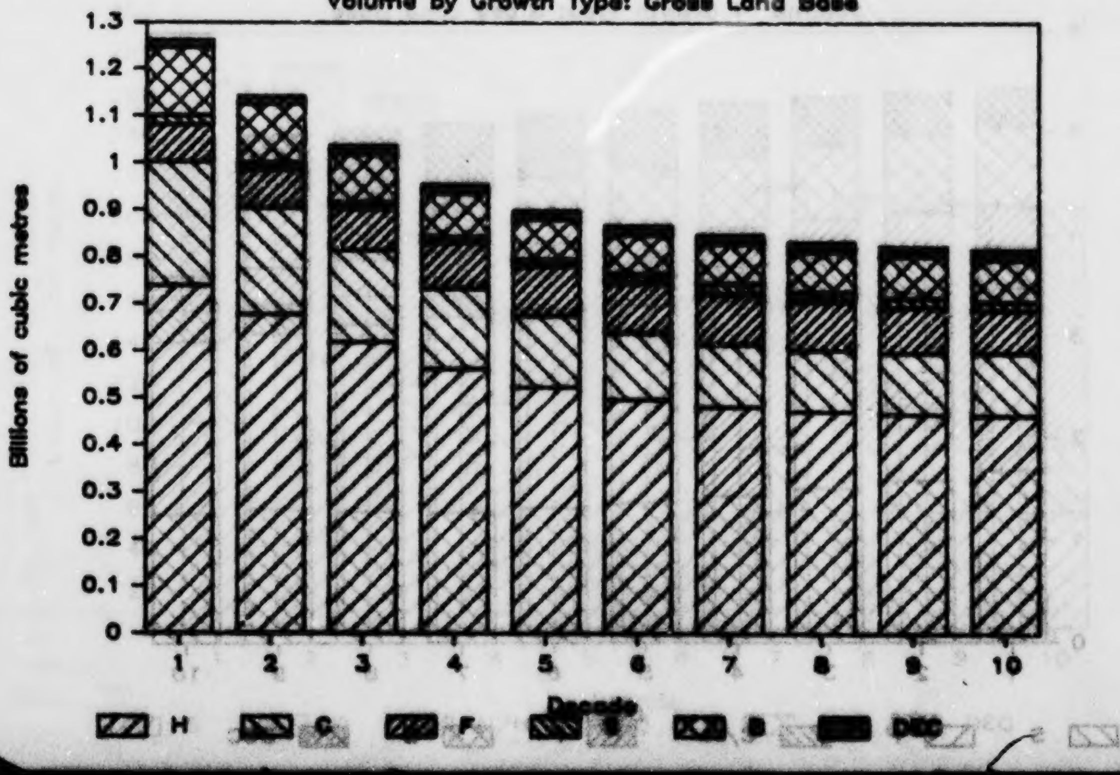


Figure B-12



COAST RESOURCE ANALYSIS REGIONS (TFL s)

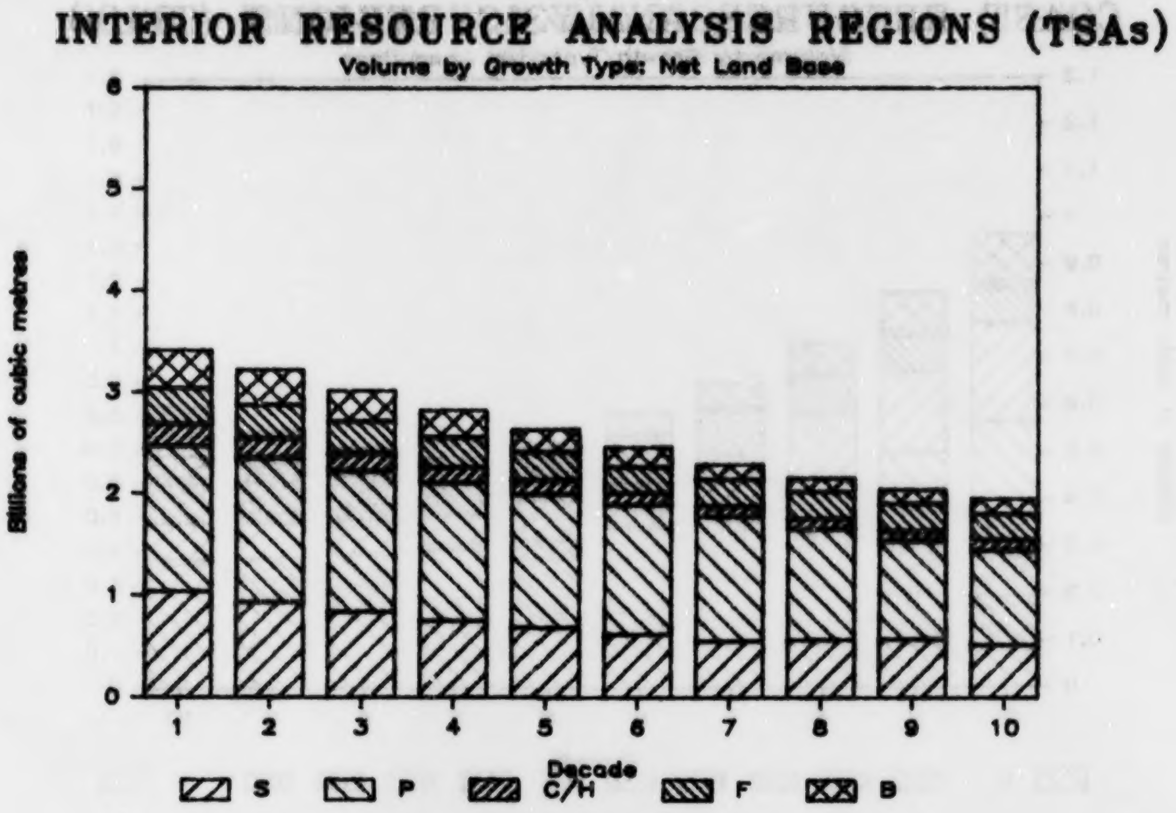
Volume by Growth Type: Net Land Base



COAST RESOURCE ANALYSIS REGIONS (TFL s)

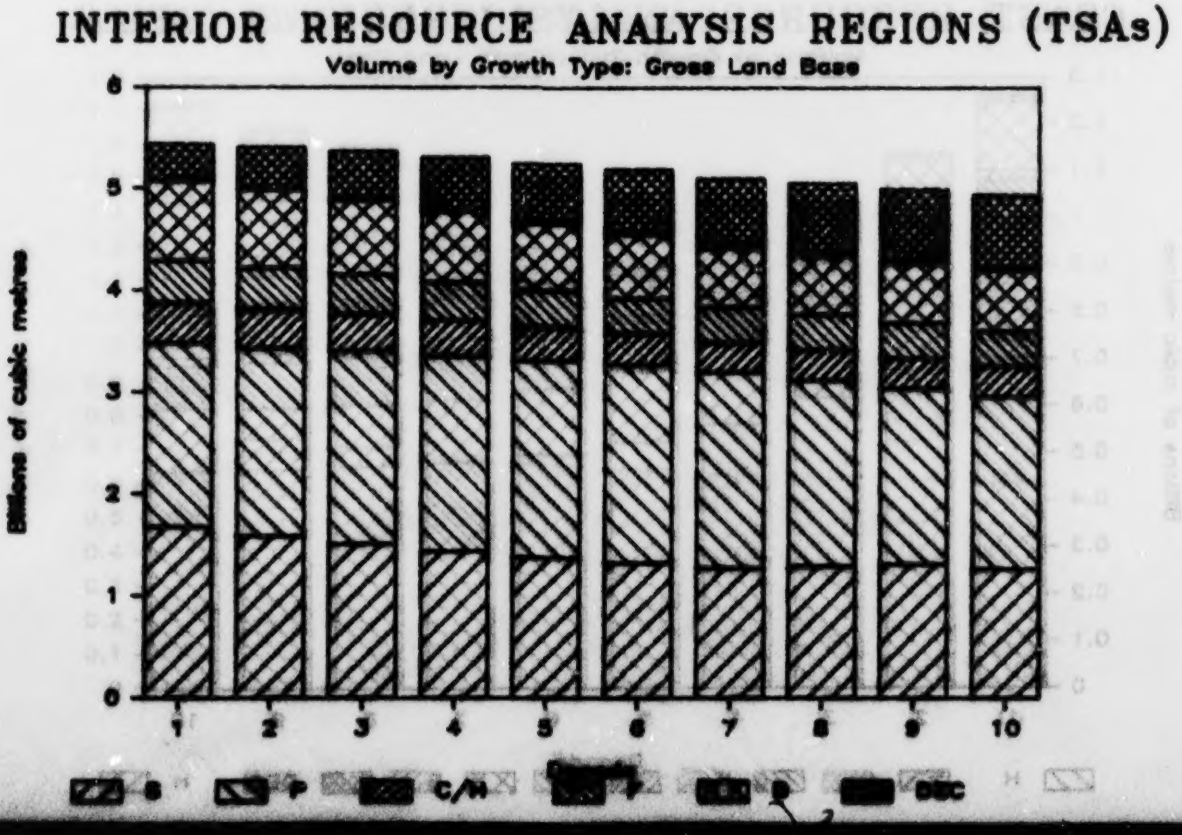
Volume by Growth Type: Gross Land Base

Figure B-13



INTERIOR RESOURCE ANALYSIS REGIONS (TSAs)

Volume by Growth Type: Net Land Base

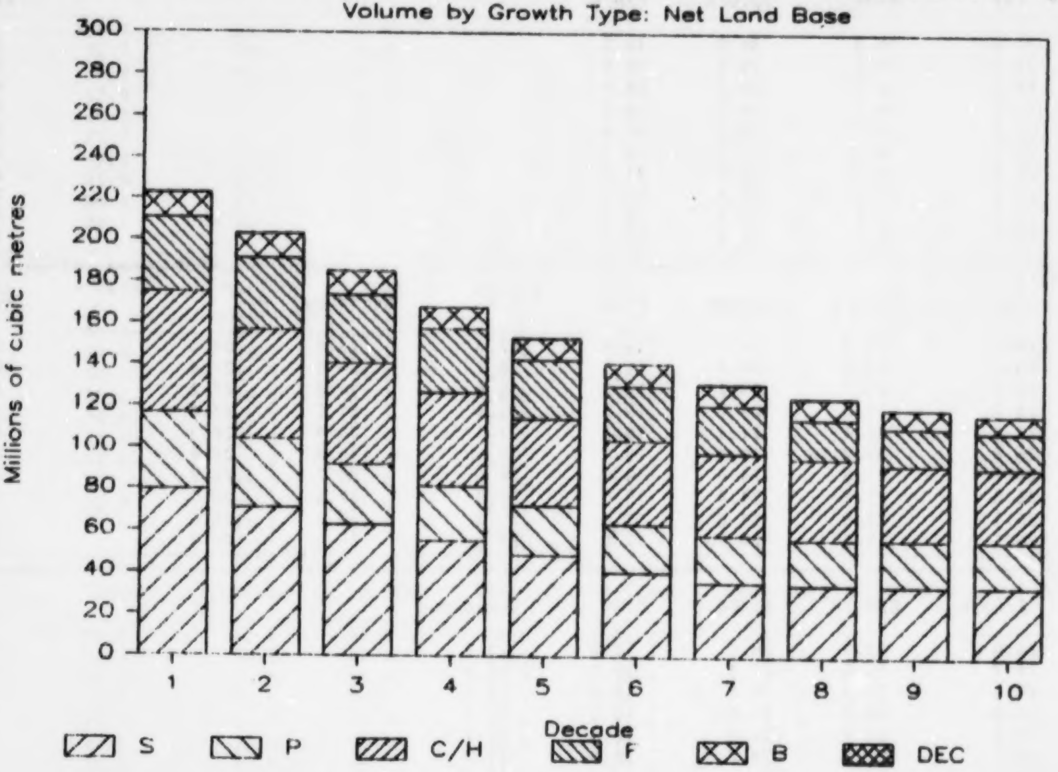


INTERIOR RESOURCE ANALYSIS REGIONS (TSAs)

Volume by Growth Type: Gross Land Base

Figure B-14

INTERIOR RESOURCE ANALYSIS REGIONS (TFLs)



INTERIOR RESOURCE ANALYSIS REGIONS (TFLs)

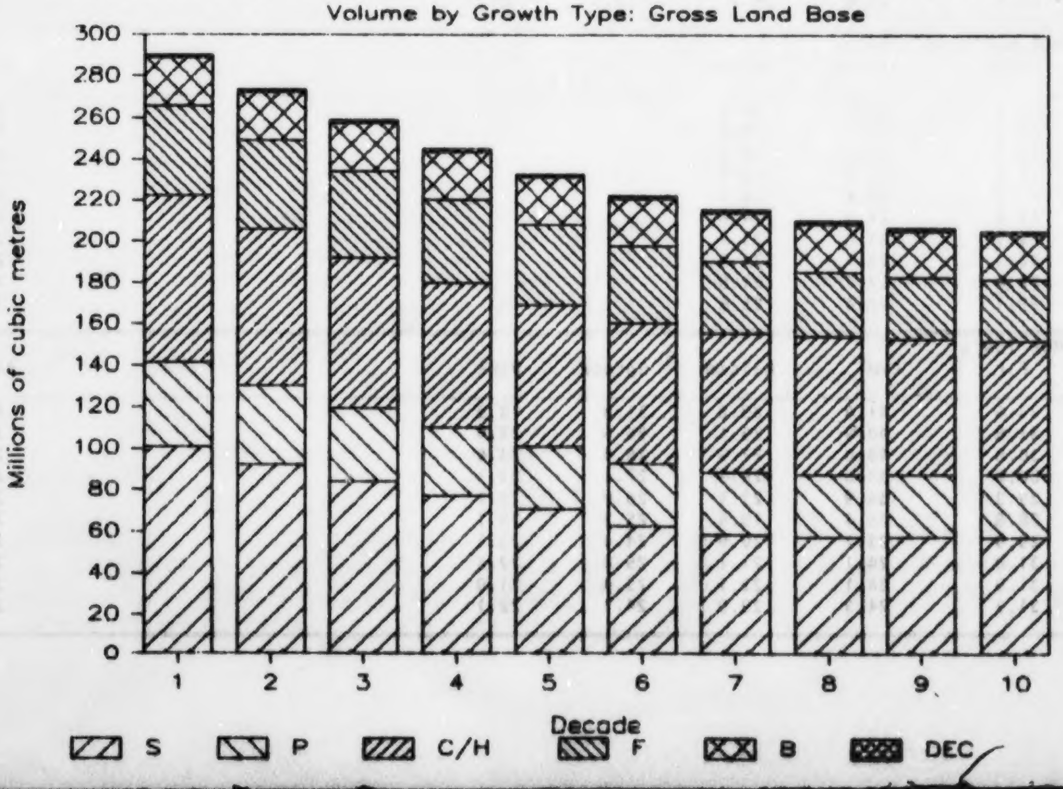


Table B-9 AVERAGE DIAMETER BY GROWTH TYPE (cm)

CARIBOO TSA's

Decade	Fir	Pine	Spruce	C/H/B	Average
1	31.5	18.8	30.0	30.5	22.9
2	30.3	18.8	29.5	29.5	22.6
3	28.4	18.8	28.8	28.4	22.1
4	27.2	18.7	28.2	25.6	21.7
5	26.2	18.7	27.6	24.9	21.4
6	25.7	18.5	27.2	25.0	21.1
7	26.8	18.3	25.4	23.5	21.0
8	27.8	17.9	25.4	23.1	20.9
9	29.0	17.7	25.4	25.2	21.0
10	29.2	17.7	24.8	26.3	20.95

KAMLOOPS TSA's

Decade	Fir	Balsam	Spruce	Pine	C/H	Deciduous	Py	Average
1	29.6	28.4	31.7	19.3	42.0	23.4	30.0	26.6
2	29.4	26.8	30.7	19.3	38.2	24.5	27.4	26.1
3	28.8	25.7	29.2	19.3	35.5	24.8	27.2	25.4
4	28.2	25.0	27.7	19.3	33.5	25.5	27.4	24.8
5	27.9	24.4	21.1	19.1	32.1	25.9	28.3	23.5
6	26.5	24.2	25.4	19.1	30.6	26.8	27.8	23.7
7	26.7	21.8	24.0	19.2	26.6	26.7	25.2	23.1
8	26.8	22.2	24.4	18.4	27.8	27.5	26.2	23.0
9	26.1	22.6	24.6	17.9	29.0	26.8	26.6	22.7
10	26.3	22.5	24.7	17.9	27.8	26.1	22.6	22.6

NELSON TSA's

Decade	F/Py/L	C/H	Sp/Ba	Pine	Deciduous	Average
1	24.6	38.9	28.8	18.5	23.7	24.5
2	24.7	35.6	27.4	18.5	24.4	24.0
3	24.5	32.9	26.2	18.5	24.3	23.4
4	24.8	29.8	25.4	18.5	25.3	23.2
5	24.6	28.7	24.6	18.8	24.4	22.9
6	24.1	27.3	24.2	18.6	23.7	22.7
7	23.7	27.2	24.1	18.4	24.6	22.2
8	23.8	28.2	23.9	18.2	25.5	22.2
9	23.3	29.0	24.1	17.8	24.9	22.0
10	23.5	28.6	24.2	17.3	25.7	21.9

PRINCE GEORGE NORTHEAST TSA's

Decade	Pine	Spruce	Balsam	Average
1	21.9	26.1	30.6	24.8
2	22.0	25.9	29.6	24.7
3	22.1	25.5	28.2	24.4
4	22.2	25.0	26.9	24.1
5	22.3	24.6	25.7	23.9
6	22.4	24.1	24.6	23.6
7	22.1	23.8	23.2	23.2
8	22.3	23.1	24.1	22.8
9	22.4	22.7	24.8	22.6
10	22.1	22.4	25.6	22.4

PRINCE GEORGE TSA's

Decade	Fir	C/H	Balsam	Spruce	Pine	Average
1	33.6	41.0	29.8	31.8	23.0	27.8
2	31.8	40.9	29.1	30.0	23.0	27.0
3	30.8	40.0	27.9	28.4	23.0	26.2
4	30.0	38.6	25.3	27.1	23.1	25.3
5	29.3	36.9	23.1	26.0	23.1	24.5
6	28.8	26.4	19.4	25.2	23.1	23.5
7	29.9	23.7	20.9	24.4	23.1	23.3
8	31.0	24.1	21.1	25.0	22.5	23.4
9	31.9	24.1	22.1	25.4	21.9	23.4
10	31.3	24.3	29.9	24.1	22.1	24.2

Table B 9 (cont'd) AVERAGE DIAMETER BY GROWTH TYPE (cm)

PRINCE RUPERT INTERIOR TSA's

Decade	C/H/B	Pine	Spruce	Average
1	30.8	23.4	29.4	27.6
2	32.1	23.0	28.3	26.9
3	30.8	22.6	27.2	26.1
4	29.9	22.2	26.2	25.4
5	28.9	21.9	25.4	24.8
6	27.7	21.6	24.6	24.1
7	27.0	21.0	25.0	23.7
8	25.5	20.6	24.3	22.9
9	24.4	21.5	24.1	23.0
10	24.1	20.3	24.1	22.3

PRINCE RUPERT COAST TSA's

Decade	Cedar	Hemlock	Spruce	Balsam	Pine	Average
1	45.3	34.2	40.7	35.8	23.3	36.4
2	42.4	33.1	37.7	33.4	24.3	34.8
3	38.1	31.7	35.2	29.9	25.0	32.8
4	36.6	30.5	33.3	29.0	24.2	31.5
5	34.4	29.1	32.4	28.1	23.8	30.1
6	31.7	27.8	32.8	27.1	24.1	28.8
7	32.6	26.4	33.7	25.2	23.1	28.0
8	30.2	25.9	31.5	23.5	23.6	27.0
9	26.9	25.8	31.9	24.7	24.2	26.6
10	27.4	25.5	32.3	26.0	24.8	26.6

VANCOUVER TSA's

Decade	Cedar	Hemlock	Spruce	Fir/Mix	Balsam	Deciduous	Average
1	49.2	42.5	45.9	34.6	43.2	32.0	40.8
2	47.0	40.0	42.6	34.5	40.7	33.6	39.6
3	44.2	38.4	39.1	33.7	38.4	31.7	37.5
4	42.0	36.4	36.9	33.7	36.3	31.6	36.2
5	39.7	34.7	35.8	33.8	35.0	31.0	35.1
6	37.4	33.9	35.4	33.9	32.3	31.5	34.2
7	36.2	32.6	35.2	34.2	29.6	30.3	33.3
8	34.9	31.9	35.0	34.3	28.9	30.7	32.9
9	33.0	31.5	34.9	34.3	28.8	30.7	32.4
10	33.1	31.2	33.9	34.2	28.8	30.9	32.3

Table B-10. Average Diameter of Selected Timber Species at Cutting Age.

Species	Age	Average Diameter (cm)			
		S. COAST	N. COAST	S. INT.	N. INT.
Fir	120	40		26	32
Cedar	120	49	45		32
Hemlock	120	39	34	34	32
Balsam	120	37		30	29
Spruce	120	43	49	30	32
Lodgepole pine	80	26	26	20	24

The diameters given in this table will vary substantially depending on site capability, but within a plantation the diameter of a species is expected to be fairly uniform.

CHAPTER B4

RANGE RESOURCE INVENTORY

This chapter contains statistics on the amount of land covered by the various range type associations and the actual use of those areas by livestock. The 14 general range types shown in Table B-11 are based upon 36 forest inventory specific type associations. Each of these types is selected on the basis of known correlations between range productivity and forest cover and is labelled according to the predominant tree species or other dominant feature. Climatic conditions provide a further refinement.

Characteristics of each of the 14 general types are presented below.

Open Range: Open Range is found within the Ponderosa Pine-Bunchgrass and dry phases of the Interior Douglas Fir biogeoclimatic zones. Plant growth is dominated by a variety of grasses and forbs. Widely scattered ponderosa pine and Douglas-fir veterans may also be present. Within the elevation range of 700 - 900 m, there are three elevational gradations; lower, middle and upper grasslands which exhibit characteristic levels of productivity under climax conditions ranging from about 550 to 1,120 kg of air-dry forage per hectare. Although these areas are generally small in size they are highly productive.

Water is a critical element on these sites because supply from both rainfall and snowfall is limited (respectively approximately 300 millimetres (mm) and 100 centimetres (cm) annually). The rich organic soils which underlie these grasslands are very susceptible to disturbance.

The lower elevational open rangelands are particularly important to the ranching industry primarily for livestock grazing during the spring and fall.

These sites must be managed carefully as they correspond to classes 1 and 2 wildlife habitat and are susceptible to degradation by over-grazing as cattle and wildlife compete for browse.

Wetland: Wetland types are typically associated with the Engelmann Spruce-Subalpine Fir and Interior Douglas Fir biogeoclimatic zones. Sedges and rushes dominate the vegetative layer. As these sites are usually underlain by imperfectly drained organic soils, moisture is not a critical factor.

Wetlands are used for summer grazing when soil moisture is low enough to allow cattle on the sites. Typically these areas are small in size but highly productive. Forage productivity ranges from 1,500 kg air-dry per hectare to in excess of 4,000 kg.

TABLE B-11. PROVINCIAL TSA TOTAL RANGE INVENTORY STATISTICS

NUMBER	SPECIFIC TYPE	AREA (ha)	PERCENT
1	Open Range	341,736	0.4
2	Wetland	1,677,290	2.0
3	Alpine	24,040,843	29.0
4	Clearings	167,732	0.2
5	Non-Vegetated	306,878	0.4
6	Roads	112,471	0.1
7	Water	2,304,214	2.8
8	Brush	1,848,142	2.2
9	N.S.R.	1,195,485	1.4
10	Conif. Forest - Age Class 1	1,387,382	1.7
11	Urban	15,092	0.0
12	N.P. Commercial Species	3,696,767	4.5
13	Fir, Larch - Age Class 2-9	3,030,191	3.7
14	Ponderosa Pine - Age Class 2,3	13,567	0.0
15	Ponderosa Pine - Age Class 4-9	88,052	0.1
16	Lodgepole Pine - Age Class 2,3	2,466,567	3.0
17	Lodgepole Pine - Age Class 4-9	6,375,542	7.7
18	Lodgepole W/C Age Class 2-9	424,611	0.5
19	Lodgepole Pine Decid.	821,095	1.0
20	Pine, Fir, Larch - Age Class 4-9	204,291	0.2
21	Pine, Fir, Larch - Age Class 4-9	429,153	0.5
22	Coniferous W/C - Age Class 2,3	1,082,125	1.3
23	Coniferous W/C - Age Class 4-9	7,740,915	9.3
24	Spruce - Age Class 2,3	506,798	0.6
25	Spruce - Age Class 4-9	8,244,267	9.9
26	Aspen	3,267,344	3.9
27	Other Deciduous	549,715	0.7
28	Lodgepole Spruce - Age Class 2,3	310,306	0.4
29	Lodgepole Spruce - Age Class 4-9	3,022,793	3.6
30	N.C.	1,444,943	1.7
31	D.S.D.	724,332	0.9
32	Pine, Fir, Larch W/C - Age Class 2,3	12,058	0.0
33	Pine, Fir, Larch W/C - Age Class 4-9	27,732	0.0
34	Fir, Larch W/C - Age Class 2-9	419,870	0.5
35	Deciduous - Age Class 1	161,814	0.2
36	Alienated	4,398,277	5.3
Unit Total		82,860,390	100

NUMBER	SPECIFIC TYPE NUMBER	GENERAL TYPE	AREA (ha)	%	UTILIZED CROWN RANGE(ha)	% AREA OF TYPE UTILIZED	ACTUAL USE AUM
1	1	Open Range	341,736	0.4	221,232	64.7	122,293
2	2	Wetland	1,677,290	2.0	275,299	16.4	61,077
3	3	Alpine	24,040,843	29.0	277,400	1.2	17,394
4	14,15	Ponderosa Pine Forest	101,619	0.1	56,104	55.2	18,597
5	13,20,21	Dry Forest	3,663,635	4.4	1,228,399	33.5	206,219
6	16,17,19	Lodgepole Pine Forest	9,663,204	11.7	1,799,203	18.6	112,569
7	18,22-25,28,29,32-34	Wet Forest	21,791,475	26.3	630,398	2.9	19,121
8	26,27,35	Deciduous Forest	3,817,059	4.6	1,420,057	37.2	76,285
9	9,10,12,30,31	Transitional	8,610,723	10.4	1,894,299	22.0	185,075
10	4	Clearings	167,732	0.2	95,334	56.8	76,293
11	5,7	Non-Vegetated	2,611,092	3.2	6,251	0.2	100
12	8	Brush	1,848,142	2.2	386,082	20.9	19,246
13	11,6	Urban	127,563	0.2	32,045	25.1	9,773
14	36	Alienated	4,398,277	5.3		0.0	
Unit Total			82,860,390	100.0	8,322,903	10.0	924,122

1. W/C - wet &/or cold forest.

Alpine: The Alpine range type is typically associated with the Alpine Tundra biogeoclimatic zone and is dominated by low shrubs, grass and sedge species. Very stunted and shrubby forms of subalpine fir, Engelmann spruce, and western and lodgepole pine occasionally occur.

Water is not as critical an element on these sites as it is in open range areas. Typically, annual rainfall is about 600 mm and snowfall about 400 cm. The soil on these sites is very sensitive to erosion because it is thin and the topography is usually rugged. The short growing season is a limiting factor in the ability of the range to produce forage.

The grass-sedge communities at lower elevation alpine range provide an important source of late summer forage for cattle. These areas are fairly productive but must be well managed because over-grazing will quickly lead to accelerated soil erosion.

Ponderosa Pine Forest: The Ponderosa Pine Forest type is generally found within the Ponderosa Pine-Bunchgrass biogeoclimatic zone and is dominated by ponderosa pine with Douglas-fir. Grasses dominate a poorly developed shrub layer.

As is the case with the open range type, water is scarce and limits forage productivity. Rainfall is approximately 300 mm per year and snowfall about 100 cm annually.

This type is important for the ranching industry. Primary use occurs during the winter, early spring and late fall. Typically these sites are potential producers of high quality forage. However, because they are so susceptible to degradation, grazing must be carefully managed.

Dry Forest: The Dry Forest type is generally associated with dry subzones of the Interior Douglas Fir biogeoclimatic zone and comprises a mixture of Douglas-fir and lodgepole pine, and to a lesser extent western larch and ponderosa pine. Pinegrass and associated forbs comprise the herb layer.

Water supply is not a critical element in these areas. Precipitation is normally near 600 mm per year and snowfall about 300 cm.

This type is primarily used as summer range. Productivity is good (averaging about 273 kg air-dry per hectare) but declines rapidly as the summer progresses. Adjacent dense forests provide good bedding cover. Because this type is moderately sensitive to disturbance, it should be carefully watched to prevent over-grazing.

Lodgepole Pine: This type occurs extensively throughout British Columbia in a number of different biogeoclimatic zones including Interior Western Hemlock, Interior Douglas-fir and Engelmann Spruce-Subalpine Fir.

Water supply, particularly in areas located within the Engelmann Spruce-Subalpine Fir zone, is not as great a limiting factor as it is in the Dry Forest type.

Summer grazing is of particular importance on these sites. Productivity ranges from zero at high stand density to about 550 kg air-dry per hectare at lower stand density. In some areas, burning and thinning are used to increase productivity. There is a great potential for wildlife/cattle conflicts in the Lodgepole Pine type as it is used extensively as wildlife habitat.

Wet Forest: The Wet Forest type is usually associated with the Montane Spruce and Interior Cedar Hemlock biogeoclimatic zones and is formed of a varied mixture of coniferous species. The predominant species are normally Engelmann spruce, lodgepole pine, subalpine fir, cedar and western hemlock.

Water supply is not a critical element on these sites since rainfall generally averages about 700 mm annually and snowfall approximates 5 metres per year.

Clearcuts are used extensively for summer grazing and dense lodgepole pine stands provide good browse. Because of the competition for browse, there is a substantial potential for conflicts between cattle and wildlife on these sites.

Deciduous Forest: This type, located primarily in the Peace River area, is the forest type which provides the best grazing because it has a rich understory. Both the herb and shrub layers are rich in nutrients and water is not a limiting factor. Forage productivity ranges to 1,000 kg air-dry per hectare. Much of the summer grazing in these locations is carried out on cultivated community pastures.

Transitional: These locations are classified as either nonproductive, disturbed or not satisfactorily restocked to a forest crop under the forest inventory system. The sites vary widely as to vegetative species and soil moisture and their value as livestock grazing range varies accordingly. For example, in the Peace River area these sites are heavily used by livestock but the transitional areas in the Mid Coast portion of the province are noncommercial or nonproductive types that do not provide any opportunity for grazing.

Clearings: These areas are typically associated with the Wet Forest type. The description of that type applies equally well to the Clearings type.

Non Vegetated: This type supports only a very small livestock population.

Brush: The Brush type occurs ubiquitously throughout the province and varies widely in its potential for grazing but does not provide good grazing range in any area.

Alienated: Alienated land (private) provides much of the most productive grazing in the province, but because they are not under Ministry of Forests management, they are not included in this report in the estimates of utilized range.

Urban: The urban classification includes a wide variety of sites such as industrial areas, pipelines and power lines. Some of these may be seeded and can provide significant grazing opportunities. Others, where there is more intensive industrial activity, provide only limited use.

CHAPTER B5

RECREATION RESOURCE INVENTORY

Part of the integrated management activity is maintaining an inventory of recreational values on some 80 million hectares of Crown lands over which the Ministry has jurisdiction.

The inventory identifies current recreational uses and demands and, in the light of existing and potential needs, identifies natural or cultural features that could generate a recreational experience.

Table B-12 below summarizes the Crown land recreation inventory for the province. It covers Crown land within timber supply areas plus Crown land within five tree farm licences (Tree Farm Licence Nos. 3, 5, 8, 14 and 23). For the Crown portion of other tree farm licences no comparable inventory information is available. Federal lands, provincial parks, Park Act Recreation Areas, Indian Reserves, municipal areas and private alienated lands are not included.

Table B-12. Recreation Inventory Summary

(All TSAs plus TFL Nos. 3, 5, 8, 14 and 23)

	Land Areas With Special Areas of Recreational Values			Land Areas With Normal Recreational Values	Total
Type of Area	Visual	Water	Other		
	(millions of hectares)				
Commercial Forest Land	4.10	2.82	2.42	32.46	41.80
Noncommercial Forest Land	0.92	0.50	1.07	4.45	6.94
Nonforested Land	1.63	0.80	3.80	32.87	39.10

"Areas with special recreational values" are those that have been given a management class rating, (i.e. where the protection and maintenance of their recreational values require special management due to their sensitivity.) In general, these areas have medium-to-high recreational values. "Areas with normal recreational values" refers to all other areas.

The areas with special recreational values are divided further into three groups:

1. Those with visual values. In these areas the management class rating was based primarily on visual features.

2. Those with water-oriented values. In these areas the management class rating was based primarily on water-oriented recreational features (e.g. waterfalls, rapids and waterbodies).

3. Those with other values (e.g. topographic features, trails, rock formations, cultural and historic features).

Flowing through lands under the ministry's jurisdiction are approximately 16,000 kms of rivers known to be navigable by canoe, kayak or raft, and thousands of fresh water lakes. These water surfaces are not included in tabular summary.

The types of conflict and types of protection and management of recreational values is different in areas with commercial wood producing activities from those without. Therefore, Table B-12 also separates the land mass into three categories of wood growing capacity:

1. Commercial forest land, which includes areas with commercial timber productivity. Only about half of the area contributes currently into the allowable annual cut.

2. Noncommercial forest land, which includes subalpine forest, noncommercial brush types and inoperable areas.

3. Nonforested land, which includes open range, alpine areas, wetland and swamp, rock, ice, etc.

We can draw the following conclusions from this table:

1. Crown land contains substantial areas (20%) with sensitive forest or wildland recreational values.

2. Over 20% of potentially commercial lands will require special management to protect their recreational values. This implies that integrated management may lead to some reduction in the timber volume available for harvesting or to an increase in the cost of timber production.

3. Nonforested Crown lands contain substantial areas (6%) with sensitive recreational values, which require protection and management.

4. Substantial areas have visual landscape values (26% of the special values are visual).

The freedom of members of the public to enter Crown land to enjoy recreational activities is part of the province's heritage and is an important element in its recreational appeal. Since most recreational activity takes place in the vicinity of roads, access development and management is a key factor in forest and wildland recreation management. Table B-13 shows how much Crown land is now accessible by road and how much land will be accessible in the next 20 years. This includes only the lands to be made accessible for forestry purposes; it does not include those that may become accessible through access development for mining or other purposes.

Table B-13. Forest and Wildland Accessible by Roads

Type of Area	Total Area (million ha)	% currently accessible	% planned within 20 years
Commercial Forest Land	41.80	57	18
Noncommercial Forest Land	6.94	37	14
Nonforested Land	39.10	35	14

The figures are estimated to be accurate within 25%, so provide an adequate indication of accessibilities by road for a 20-year planning horizon.

Currently, accessible lands do not include areas beyond the crest of a watershed or more than 8 km away from a seasonal four-wheel drive or higher standard road. And where a four-wheel drive or better road exists, it must have uninterrupted connection to the provincial highway system either over land or via a scheduled regular ferry system. Therefore areas near inactive roads in isolated coastal inlets are considered currently inaccessible. (When estimating inaccessible areas, the minimum size considered was 5,000 hectares.)

Although roads are currently the most important means of access, the expanding use of all-terrain vehicles and small aircraft, may create new access management problems during the next ten years.

CHAPTER B6

TIMBER, RANGE AND RECREATION RESOURCE MAPS

This Chapter contains a set of twelve maps showing the distribution of timber, range and recreation resources in relation to land tenure. Eight figures are computer generated colour maps which provide a visual overview of selected forest and range resource parameters and land tenure for the Province of British Columbia. These include:

Figure B-15. Forest Cover - Major Species Groups
Figure B-16. Forest Cover - Productivity
Figure B-17. Forest Cover - Degree of Disturbance
Figure B-19. Land Tenure - Percent Occurrence of Private Ownership
Figure B-20. Range Inventory - General Range Types
Figure B-21. Range Inventory - Percent Occurrence of Open Range Lands
Figure B-22. Range Inventory - Percent Occurrence of Transitional Forest Range Lands
Figure B-23. Range Inventory - Predominance of Selected Range Types

The data presented in these maps were derived from the provincial forest inventory maintained by the Ministry of Forests which includes all Crown managed forest land. Inventories for major parks, tree farms and tree farm licences are not included in the ministry's inventory data base and hence are not reported. The forest area data were current to December 1983 and the culmination annual increment coefficients used to determine productivity were current at May 1, 1984.

The summary, compilation and display of the data was accomplished through the development of a specifically designed system outlined below.

(1) The basic data was extracted at full resolution, namely resultant forest cover element. Some 3.5 million elements were processed for the summary.

(2) These data were summarized to their respective map sub-grid (1.25 minute by 1.25 minute for 1:15840 National Topographic Series (NTS) 7.5 minute by 7.5 minute maps; 2.5 minute by 2.5 minute for 1:31680 NTS 15 minute by 15 minute maps; or 2,000 m grids) and then allocated to their respective 4,000 m Universal Transverse Mercator (UTM) grids based on the location of the sub-grid centroid. Using this approach the presence of a single element in a sub-grid results in an entire 4,000 m UTM grid being displayed thus smoothing and slightly extending the outline of the Province. In addition, the absence of sub-grids in the Cranbrook TSA and the south half of the Prince George Special Sales Area resulted in all 4,000 m UTM grids whose centroid fell within the map sheet being

allocated to the same theme and consequently giving a blocky appearance to the color map in that area.

(3) The allocation of the grid to a particular color code was based on the type having the greatest area. For example, a grid having 40% of its area in fir and 30% for both cedar and hemlock would be assigned to fir. The result is that major types tend to be overestimated at the expense of minor types.

(4) All means were calculated as weighted means.

(5) Creation of the final maps was accomplished by displaying and photographing the data on an Intergraph colour display station.

The remaining figures include resource information that is not in the forest inventory data base and which therefore could not be depicted in the same manner as the previous figures. These include:

Figure B-18. Tree Farm Licences - Maturity of Timber Resources
Figure B-25. Rangelands - Location of Designated Range Units
Figure B-26. Forest Recreation - Inventory of Recreation Values
Figure B-27. Forest Recreation - Accessibility By Roads

RESOURCE MAPS

FIGURE B-15. FOREST COVER - MAJOR SPECIES GROUPS

DATA: Stocked productive forest land

Figure B-15 describes seven major species groups in the province. Lodgepole pine (red) is by far the most prevalent species and is common throughout British Columbia with the exception of the west coast.

There is a total of 10 growth types used elsewhere in the Resource Analysis but only 7 are shown on the color maps. The whitebark pine, yellow pine, and larch groups are combined with other groups.

GRID DESIGNATIONS:

Name	Composition
Fir	Douglas-fir, larch, ponderosa pine, western white pine
Cedar	western red cedar, yellow cedar
Hemlock	western and mountain hemlock
Balsam	alpine, amabalis and grand fir
Spruce	Sitka, Englemann, black and white spruce
Lodgepole Pine	lodgepole pine
Deciduous	alder, aspen, birch, maple and cottonwood
Nonapplicable	all other lands
Excluded lands	TFLs, TFs, Major Parks and Private

ALLOCATION RULES:

1) Pure species given total type area
2) Where two or more leading species occur, 60% of type area allocated to the first leading species and 40% of area allocated to second leading species
3) Grid allocated according to greatest area within the 4,000 m UTM grid.

FOREST COVER - MAJOR SPECIES GROUPS

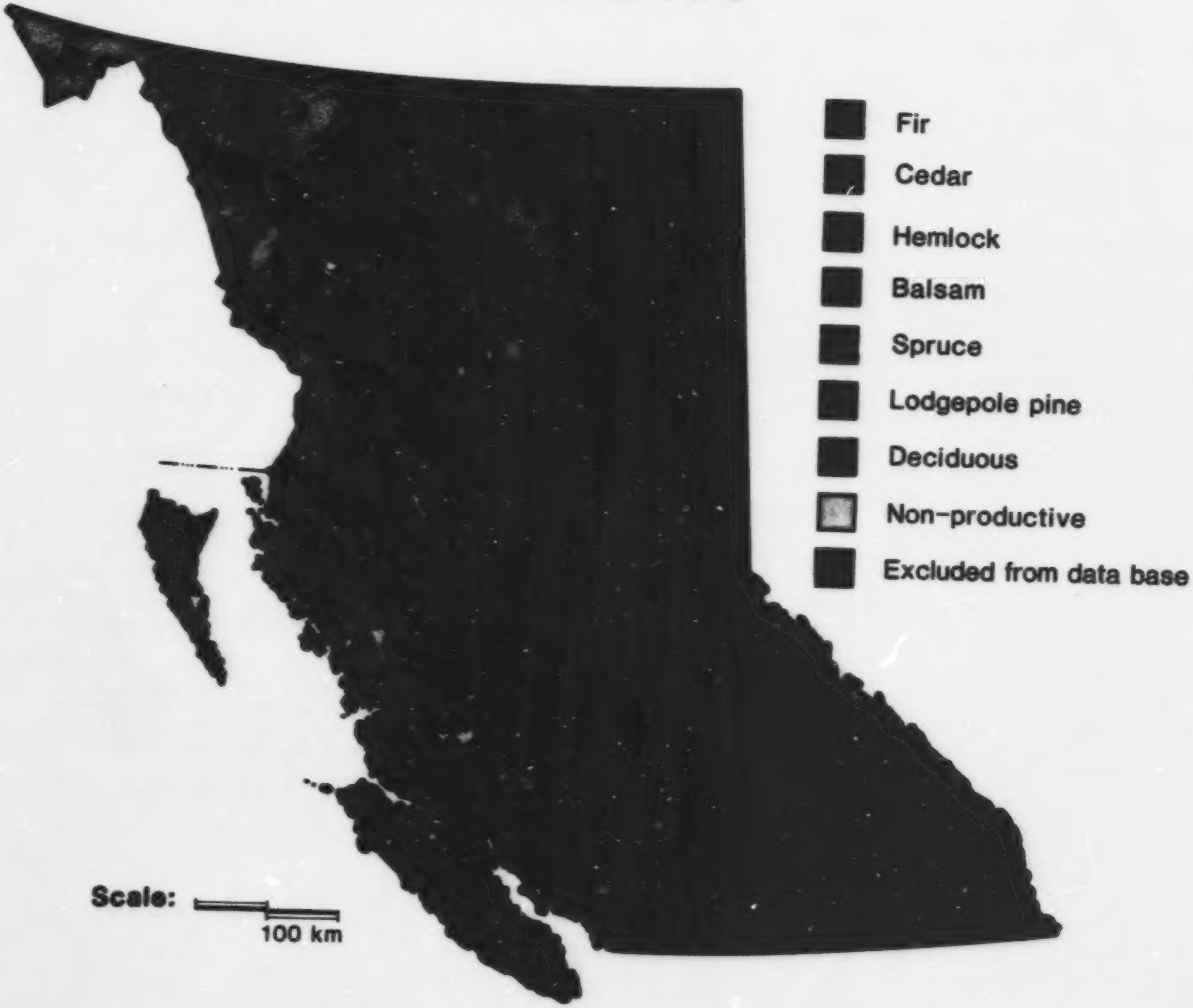

Fir
Cedar
Hemlock
Balsam
Spruce
Lodgepole pine
Deciduous
Non-productive
Excluded from data base
Scale:
100 km

FIGURE B-16. FOREST COVER - PRODUCTIVITY

DATA: Stocked productive forest land

Figure B-16 describes the productivity of forst land. The categories indicate the average annual growth rate that can be expected if forests are harvested at the optimal time (culmination age). By far, the most prevalent productivity is the 1.21 - 2.5 m^3/ha/yr. category (yellow). Only the coastal and rocky mountain trench types indicate higher productivity (green shades).

GRID DESIGNATIONS:

Name	Composition
0 - 1.2 m^3/ha/yr at culmination age	all sites, all species
1.21 - 2.5 m^3/ha/yr at culmination age	all sites, all species
2.51 - 5.0 m^3/ha/yr at culmination age	all sites, all species
5.01+ - m^3/ha/yr at culmination age	all sites, all species
Nonapplicable	all other lands
Excluded Lands	TFLs, TFs, Major Parks, Private

ALLOCATION RULES:

1) Annual increment at culmination age using Forest Inventory Zone, site class and growth type group was determined for each stand regardless of actual stand age

2) Theme allocated on weighted mean increment at culmination age of stands within the 4,000 m UTM grid

FOREST COVER - PRODUCTIVITY

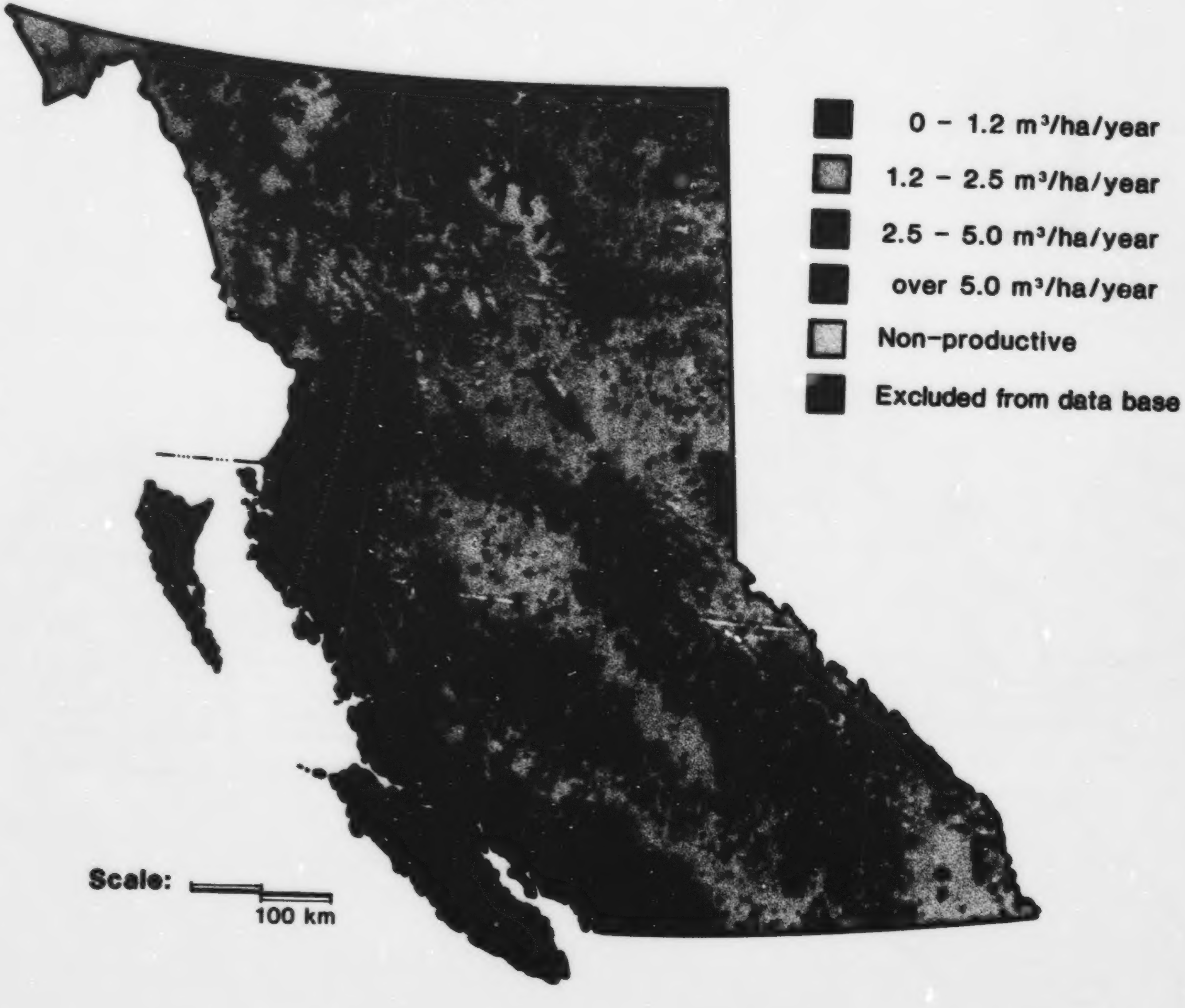

0 - 1.2 m³/ha/year
1.2 - 2.5 m³/ha/year
2.5 - 5.0 m³/ha/year
over 5.0 m³/ha/year
Non-productive
Excluded from data base
Scale:
100 km

FIGURE B-17. FOREST COVER - DEGREE OF DISTURBANCE

DATA: Stocked and nonstocked productive forest land

Figure B-17, describing degree of disturbance, shows the pattern of logging and fire activities throughout the province. The first category, 0-40 years, indicates the highest level of disturbance and the fourth category, 121+ years, may indicate negligible disturbance. Caution should be exercised in interpreting this category, however, as certain of the 16 km^2 grids could represent total disturbance on one-half of the area and no disturbance on the other. For example, there has been considerably more logging activity on the Queen Charlotte Islands than is depicted. All in all, though, the themes can be considered a pictoral depiction of disturbance on a broad scale.

GRID DESIGNATIONS:

Name	Composition
0 - 40 years	all sites, all species
41 - 80 years	all sites, all species
81 - 120 years	all sites, all species
121+ years	all sites, all species
Nonapplicable	all other lands
Excluded Lands	TFLs, TFs Major Parks and Private

ALLOCATION RULES:

1) Stand age projected to 1984 used as age
2) NSR and DSD lands given age of 0
3) Theme allocated on weighted mean age of stands within the grid

FOREST COVER - DEGREE OF DISTURBANCE

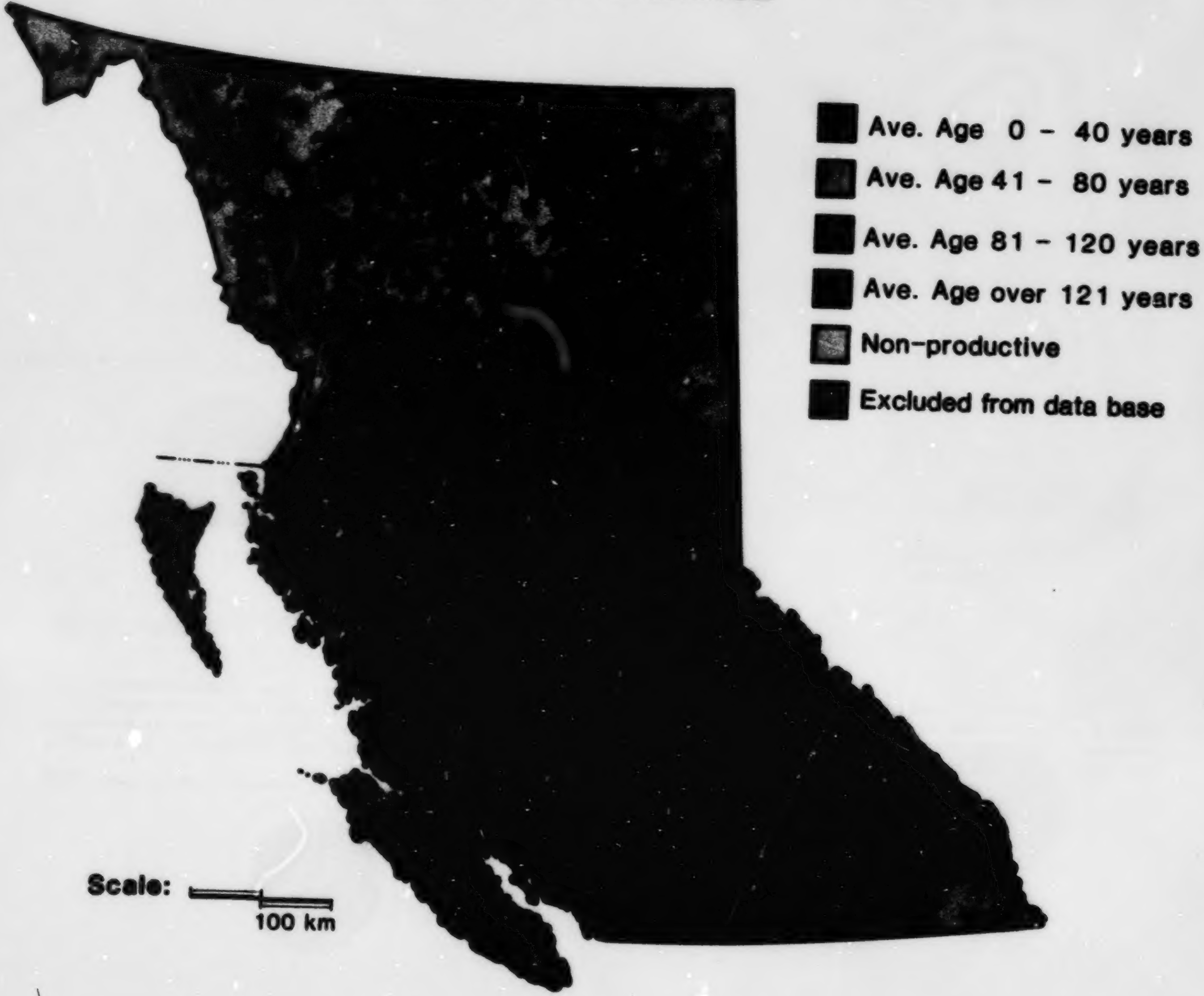

Ave. Age 0 - 40 years
Ave. Age 41 - 80 years
Ave. Age 81 - 120 years
Ave. Age over 121 years
Non-productive
Excluded from data base
Scale:
100 km

FIGURE B-18. TREE FARM LICENCES - MATURITY OF TIMBER RESOURCES

DATA: Mature and immature forest land

Figure B-18 illustrates the extent of mature and immature forest cover occuring within TFLs. It is difficult to show a further breakdown into sites and species types and composition due to the inconsistency in inventory data aggregations available among TFLs. Other inventory data for the TFLs could not be aggregated in a manner that allowed mapping on a regional scale. This information is provided in tabular form in Chapter B-2.

GRID DESIGNATIONS:

Name	Composition
mature forest	all sites, all species
immature forest	all sites, all species

TFL INVENTORY - MATURITY OF TIMBER RESOURCES

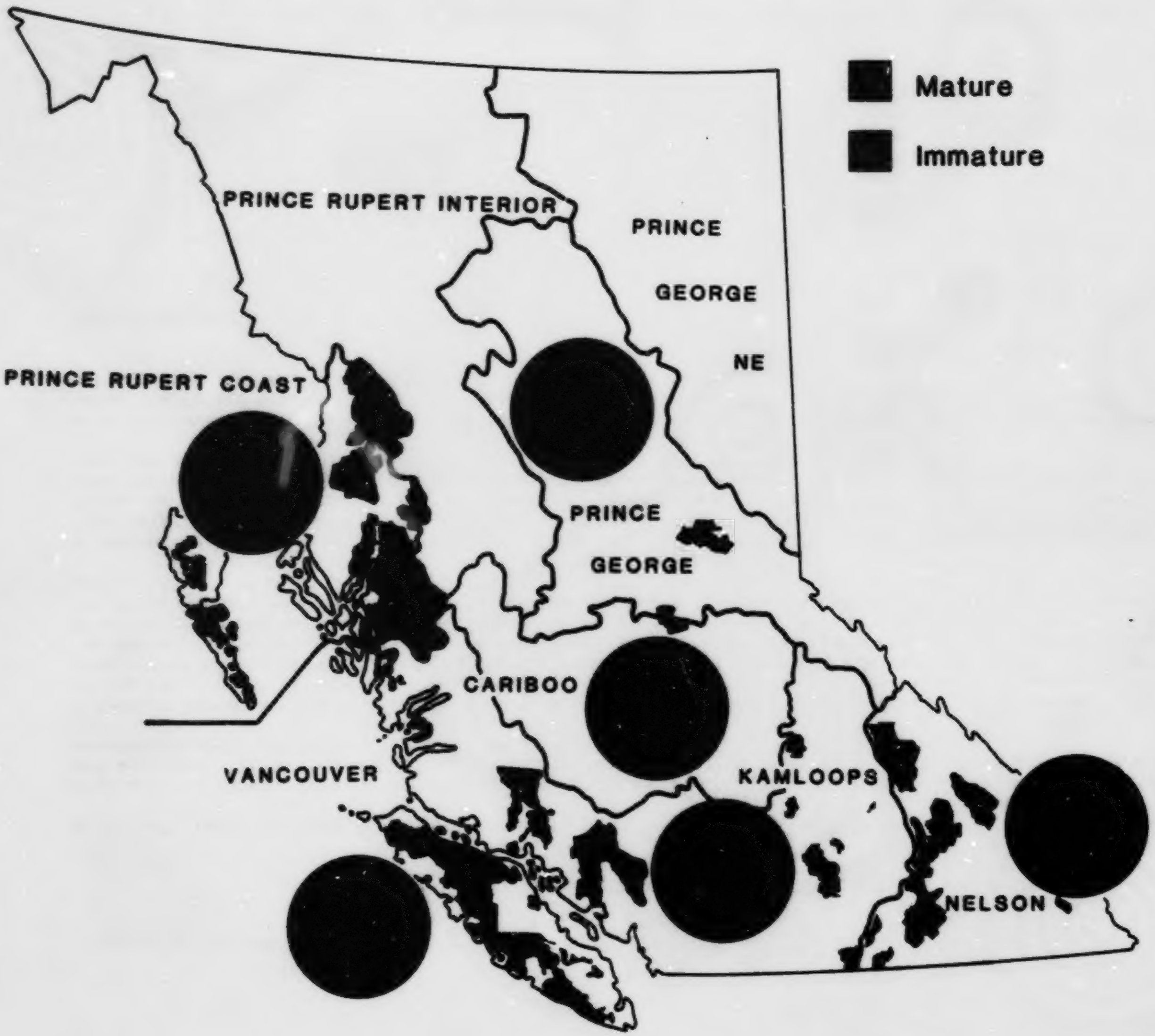

■ Mature
■ Immature
PRINCE RUPERT INTERIOR
PRINCE GEORGE NE
PRINCE RUPERT COAST
PRINCE GEORGE
CARIBOO
VANCOUVER
KAMLOOPS
NELSON

FIGURE B-19. LAND TENURE - PERCENT OCCURRENCE OF PRIVATE OWNERSHIP

DATA: All lands included in the provincial forest inventory data base

Figure B-19, showing percent occurrence of private ownership, includes only the land component; water areas are excluded. It is readily evident that heavy concentrations of privately-held lands occur in the most accessible areas and often on productive forest sites.

Alienated land constitutes approximately 5.3% of the land area in the province. The alienated land is located in the major river valleys and the plains east of the Rocky Mountains. The extent and proximity of private land, which constitutes the base ranches for commensurability calculations to Crown range, is important. In the Nelson Forest Region and most of the Kamloops and Cariboo Forest Regions there are ranches adjacent to Crown lands which could utilize additional forage if range permits or licences were available. In portions of the Prince Rupert and Prince George Forest Regions there is also a shortage of forage on particular range units.

A second consideration related to current and future land alienations is the impact that land alienation and land settlement have upon (a) the Crown land base and forage production directly, and (b) the utilization of forage by livestock on the remaining land base. These important land alienation and fringe effects are widely felt throughout British Columbia because of the impact of geography upon land settlement and the attraction of the land and water resources for recreational and rural subdivisions.

A third consideration is that, as the agricultural margins are pushed further into the forested Crown land base, the forage production lost to agriculture usually must be replaced. Subsequent development of the agricultural land may create additional demand for forage.

GRID DESIGNATIONS:

Name	Composition
No Private ownership	all lands
0.1 - 2.5% private ownership	all lands
2.51 - 5.0% private ownership	all lands
5.01 - 10.0% private ownership	all lands
10.01 - 20.0% private ownership	all lands
20.01 - 50.0% private ownership	all lands
50.01+% private ownership	all lands
Excluded Land	TFLs, TFs, Major Parks

ALLOCATION RULES:

(1) area of private land expressed as a percent of total area of land within the grid

EXCEPTIONS: On the east coast of Vancouver Island and southern mainland coast most private lands were excluded from the inventory data base and consequently little or no private ownership is shown. In other areas of the Province private lands were included in the data base though not necessarily classified for forest cover.

LAND TENURE – PERCENT OCCURRENCE OF PRIVATE OWNERSHIP

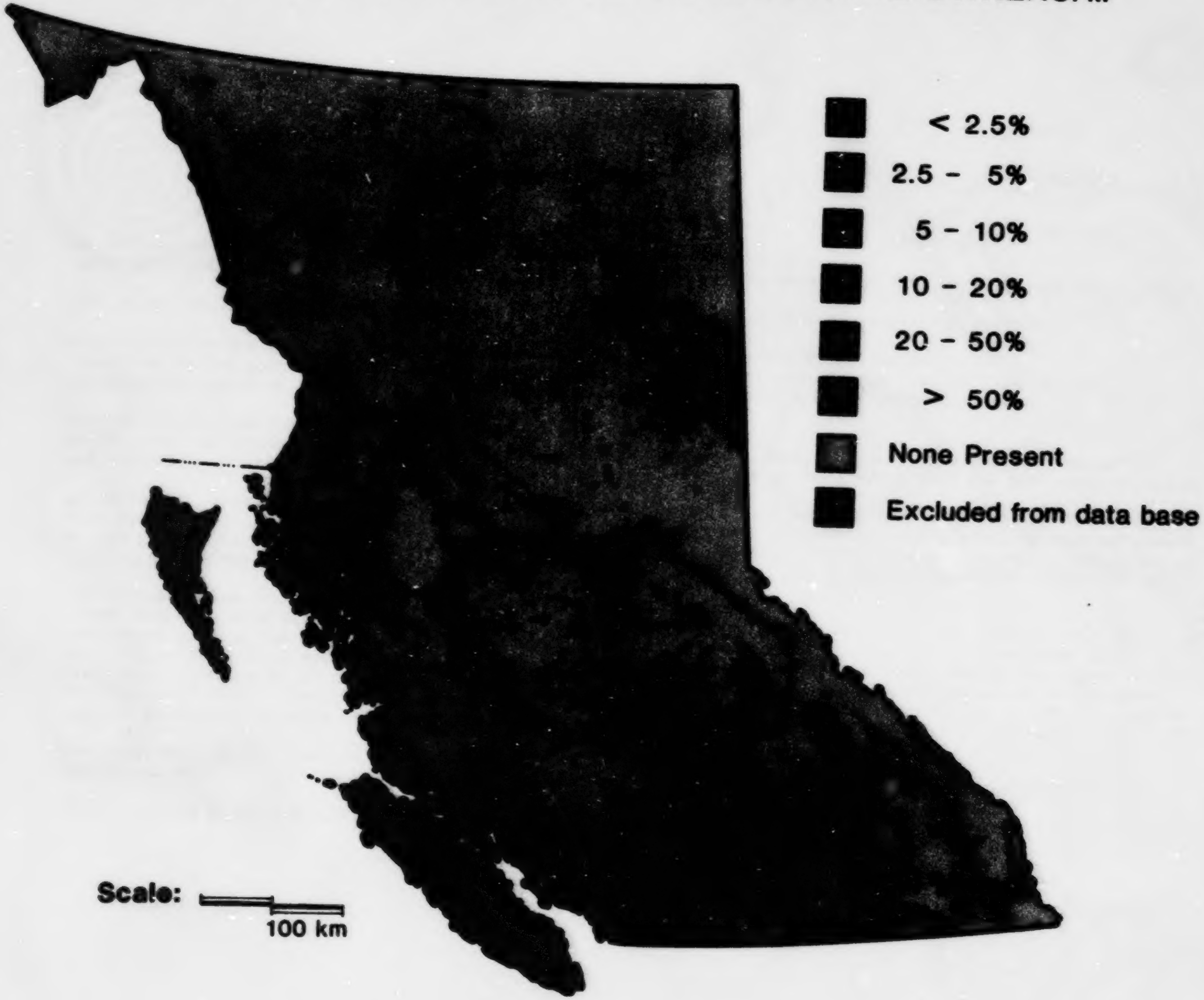

< 2.5%
2.5 – 5%
5 – 10%
10 – 20%
20 – 50%
> 50%
None Present
Excluded from data base
Scale:
100 km

FIGURE B-20. RANGE INVENTORY - GENERAL RANGE TYPES

DATA: All lands included in the provincial forest inventory data base.

The forest data base is represented by 9 categories in Figure B-20. The relationship of the 9 categories to the 14 general Range Types is described below.

The Dry Rangeland category, which includes Open Range, Ponderosa Pine Forest, Dry Forest, Clearings and Urban general range types, covers 5.3% of the land area and contributes approximately 47% of the forage utilized by livestock. Open range is 0.4% of the land area, contributes about 13% of the forage harvested by livestock and is discussed below with Figure B-21. The majority of the Dry Rangeland is comprised of Dry Forest which represents 4.4% of the area and contributes 22% of the forage harvest. Clearings which contribute 8% of the forage and over 0.2% of the land base include community pastures. Dry Rangeland is the leading type mainly in the southern interior portion of the province.

Transitional/Brush occupies 12.6% of the area and contributes 22% of the forage harvested by livestock. Most of the forage harvested by livestock comes from Coniferous Forest-Age Class 1, NSR and DSD which represent 4.0% of the area. The Transitional/Brush which appears on Figure B-20 is mainly nonproductive species from a forestry and livestock perspective. The discussion about Figure B-22 expands this explanation.

The Deciduous Forest, Lodgepole Pine Forest and Wet Forest all clearly show where they are the leading General Range Type. Deciduous Forests and Lodgepole Pine Forests are important for forage production. Deciduous Forests include Deciduous Forests-Age Class 1.

The Wetlands shown in Figure B-20 as the leading type contribute only a minor level of forage harvested by livestock in the Prince George Region. The more important wetlands are not the leading type, appear extensively in the central interior and are discussed in conjunction with Figure B-23.

The forage harvested by livestock from the Alpine Type is important geographically and seasonally.

These data are best estimates, reflect existing livestock and range management practices in 1983/84 and will be revised as scientifically based range inventory data become available.

RANGE INVENTORY - GENERAL RANGE TYPES

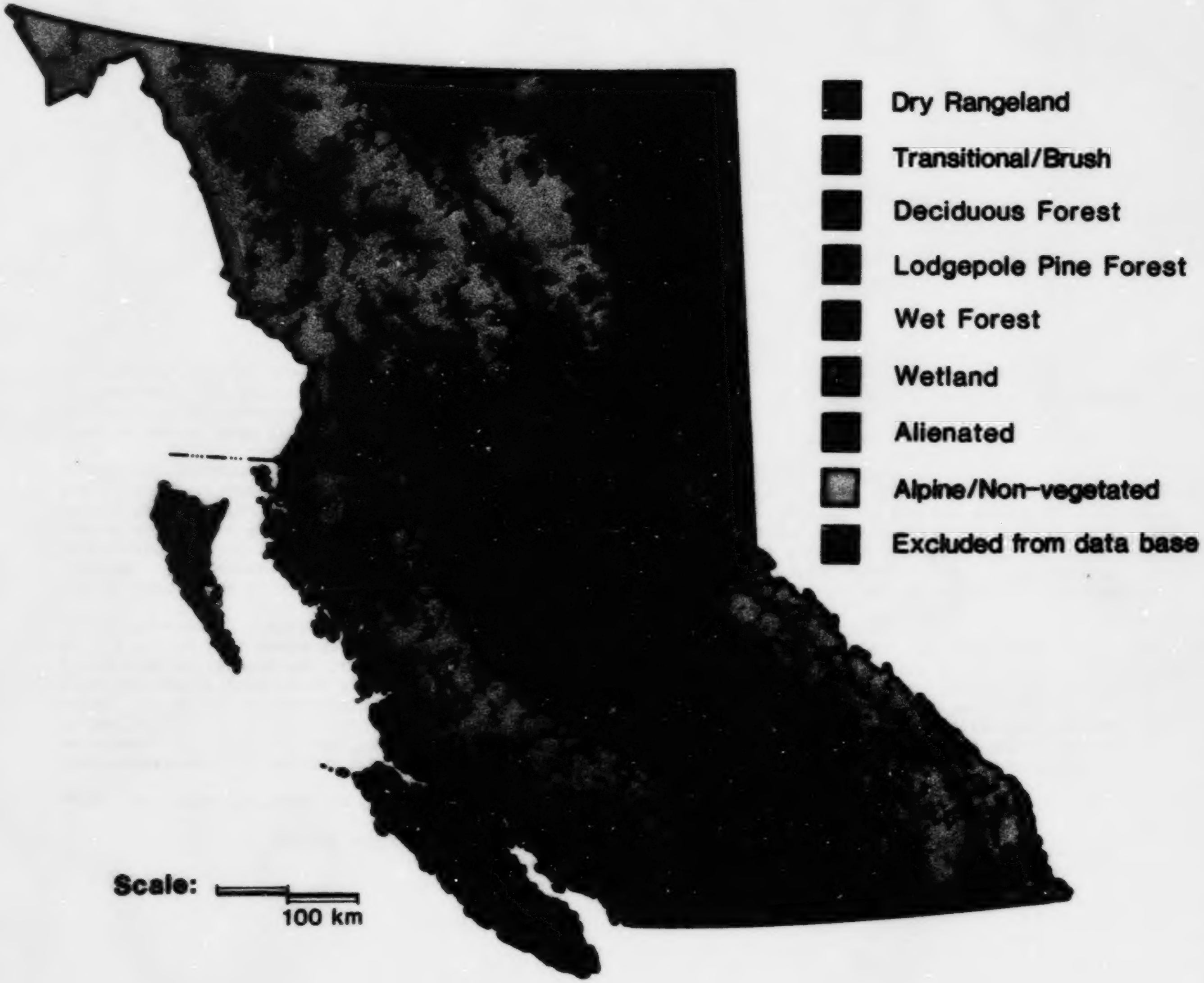

Dry Rangeland
Transitional/Brush
Deciduous Forest
Lodgepole Pine Forest
Wet Forest
Wetland
Alienated
Alpine/Non-vegetated
Excluded from data base
Scale:
100 km

FIGURE B-21. RANGE INVENTORY - PERCENT OCCURRENCE OF OPEN RANGELANDS

DATA: All lands included in the provincial forest inventory data base.

Open rangelands, as defined in the Forest Inventory Data Base, represent 4% of the total land in the province. Of the total 341,736 ha the regional distributions are as follows: (a) Prince George Northeast, 10,952 ha; (b) Prince George, 3,008 ha; (c) Nelson, 42,742 ha; (d) Cariboo, 141,254 ha; (e) Prince Rupert Coast, 10 ha; (f) Prince Rupert Interior, 9,394 ha; (g) Kamloops, 134,376 ha; and (h) Vancouver, 0 ha. This distribution of open range is reflected in Figure B-21 with the Cariboo and Kamloops Regions having a wide dispersion of varying but low-level percentage of open range. The open range in the Nelson Region is located mainly in the East Kootenay and is distributed evenly at a low-level percentage. The open range in Prince George Northeast is distributed at varying percentage levels.

The 4% open range at a provincial level provided approximately 13% of the forage harvested by livestock in 1983/84. The corresponding figures for Cariboo, Kamloops and Nelson Forest Regions are 14, 15 and 22% respectively. The percent of open range utilized by livestock varies from approximately 80% in the Prince George and Prince Rupert Forest Regions to 72% in Cariboo Forest Region. 65% in Nelson Forest Region and 54% in the Kamloops Forest Region. The percent of area utilized by livestock is influenced mainly by topography but is also influenced by access trails and proximity to ranches. Open range is of importance to wild ungulates throughout the province.

These areas of Open Range throughout the province, as shown in Figure B-21, are considered to be most susceptible to knapweed invasion but the Ponderosa Pine Forest and much of the Dry Forest are also susceptible. In general the area leading in Dry Rangeland in Figure B-20 is most susceptible to knapweed invasion as well as possibly Transitional.

RANGE INVENTORY -
PERCENT OCCURRENCE OF OPEN RANGELANDS

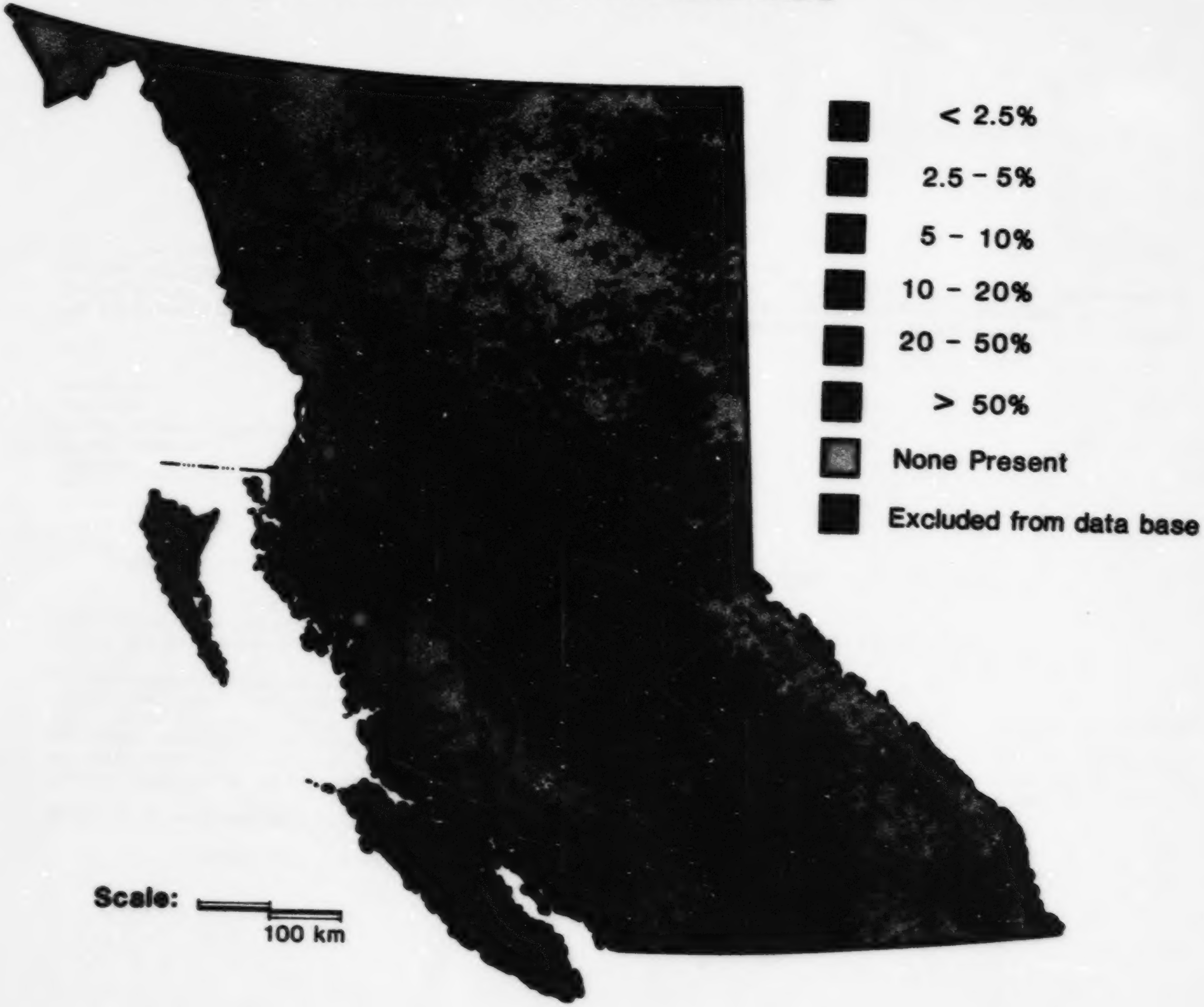

< 2.5%
2.5 - 5%
5 - 10%
10 - 20%
20 - 50%
> 50%
None Present
Excluded from data base
Scale:
100 km

FIGURE B-22. RANGE INVENTORY - PERCENT OCCURRENCE OF TRANSITIONAL FOREST RANGELANDS

DATA: All lands included in the provincial forest inventory data base.

Transitional forest rangelands consists of NSR (Not Satisfactorily Restocked), Coniferous Forest-Age Class 1, NP (Nonproductive) Commercial Species, NC (Noncommercial Species), and DSD (Disturbed, Stocking Doubtful). In aggregate there are 8.45 million ha of transitional forest of which the above described types are respectively 14.1, 16.4, 43.8, 17.4 and 8.6%. In range areas where livestock grazing occurs much of the Coniferous Forest-Age Class 1 and some NSR and DSD are utilized by livestock. The extent of use of NP Commercial Species and Noncommercial Species by livestock is not known.

If the NSR is aggregated with Coniferous Forest-Age Class 1 and DSD, the resulting areas of interest (aggregate) in hectares for potential livestock grazing and grass seeding are as follows:

Region	Aggregate	Percent of transitional
Prince George East	614,325	15.3
Prince George	692,607	71.4
Nelson	246,423	61.3
Cariboo	340,135	86.8
Prince Rupert	53,023	14.3
Prince Rupert Interior	732,725	53.5
Kamloops	355,487	76.8
Vancouver	272,474	43.7
Total	3,307,199	38.4

The distribution of Transitional Forest shows areas of potential interest for range management for livestock. In particular, Figure B-22 is indicative of sites for potentially important forested range areas in the Cariboo and Kamloops Forest Regions. In the Kamloops Forest Region, for example, 84,538 AUMS, approximately 25% of the total, were harvested from 250,958 ha of Transitional Forest.

RANGE INVENTORY - PERCENT OCCURRENCE OF TRANSITIONAL FOREST RANGELANDS

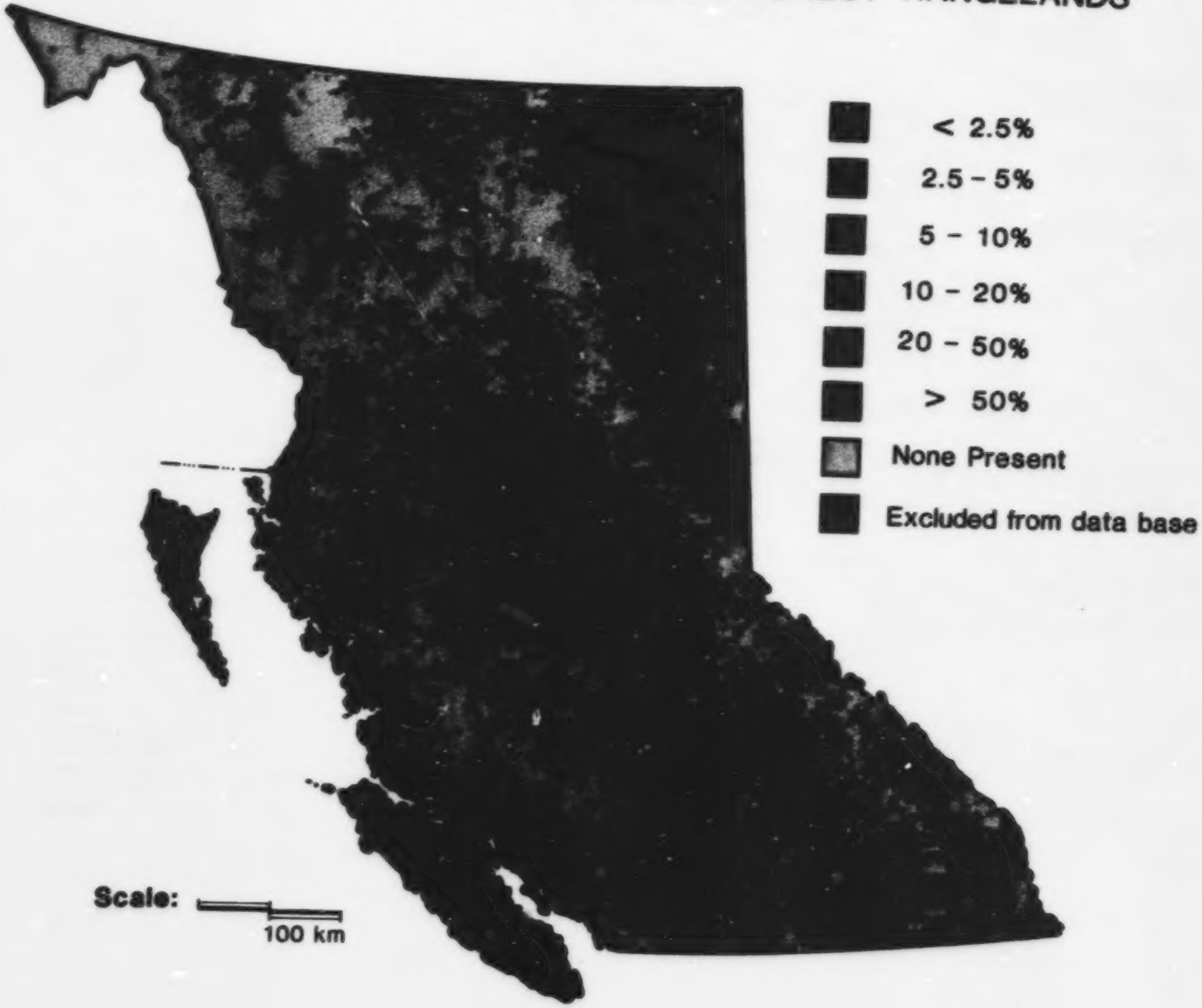

< 2.5%
2.5 - 5%
5 - 10%
10 - 20%
20 - 50%
> 50%
None Present
Excluded from data base
Scale:
100 km

FIGURE B-23. RANGE INVENTORY - PREDOMINANCE OF SELECTED RANGE TYPES.

DATA: All lands included in the provincial forest inventory data base.

The purpose for including Figure B-23 is to isolate General Range Types which were not highlighted as a leading type in Figure B-20 and were not adequately covered in (a) Figure B-22 - Range Inventory - Percent Occurrence of Transitional Forest Rangelands or (b) Figure B-21 - Range Inventory - Percent Occurrence Open Rangelands. The General Types included in Figure B-23 are Wetland (2.0, 6.6), Transitional Forest (10.4, 20.0), Clearing (0.2, 8.3), Brush (2.2, 2.1) and Urban (0.2, 1.1) where the first number in the bracket is the percent of area and second number is the percent of AUMs harvested by livestock in 1983/84. In total these general types represent 15% of the land area and 38.1% of the AUMs harvested in 1983/84. The map is color coded based upon the leading general type from this reduced set of general types.

Under the classification used in Figure B-23, Wetlands are predominant through much of the interior part of British Columbia. The leading Wetlands were mainly located in the northeast portion of the province but in the Cariboo Forest Region small areas of Wetlands contributed 11% of the AUMs harvested by livestock and were one of five General Types which contributed more than 10% of the harvested AUM's.

Transitional Forests contributed approximately 16% of the AUM's harvested by livestock in the Cariboo, Nelson and Prince George regions and approximately 25% of the AUM's harvested by livestock in Kamloops and Prince George Northeast. Consequently, Transitional Forests are dominant where wetlands are not. Note that the Transitional Forest along the mid-coast and in Prince George Northeast in principally NP Commercial Species and NC. The latter are considered to have limited value for livestock grazing.

Brush appears mainly in Prince George Northeast, Nelson and Prince Rupert. In total Brush contributes only about 2% of the livestock harvested AUM's and represents about 5% of the AUM's in Prince George Northeast and about 4% in the Cariboo region.

In aggregate, clearings contribute in a major way to forage harvested by livestock. However the land area is small and does not show extensively in Figure B-23. There may also be a need to update the land classification, particularly for the Prince George region.

In total, while this reduced set of types represents a small land area, it contributes in a major way to meeting range management production goals.

RANGE INVENTORY – PREDOMINANCE OF SELECTED RANGE TYPES

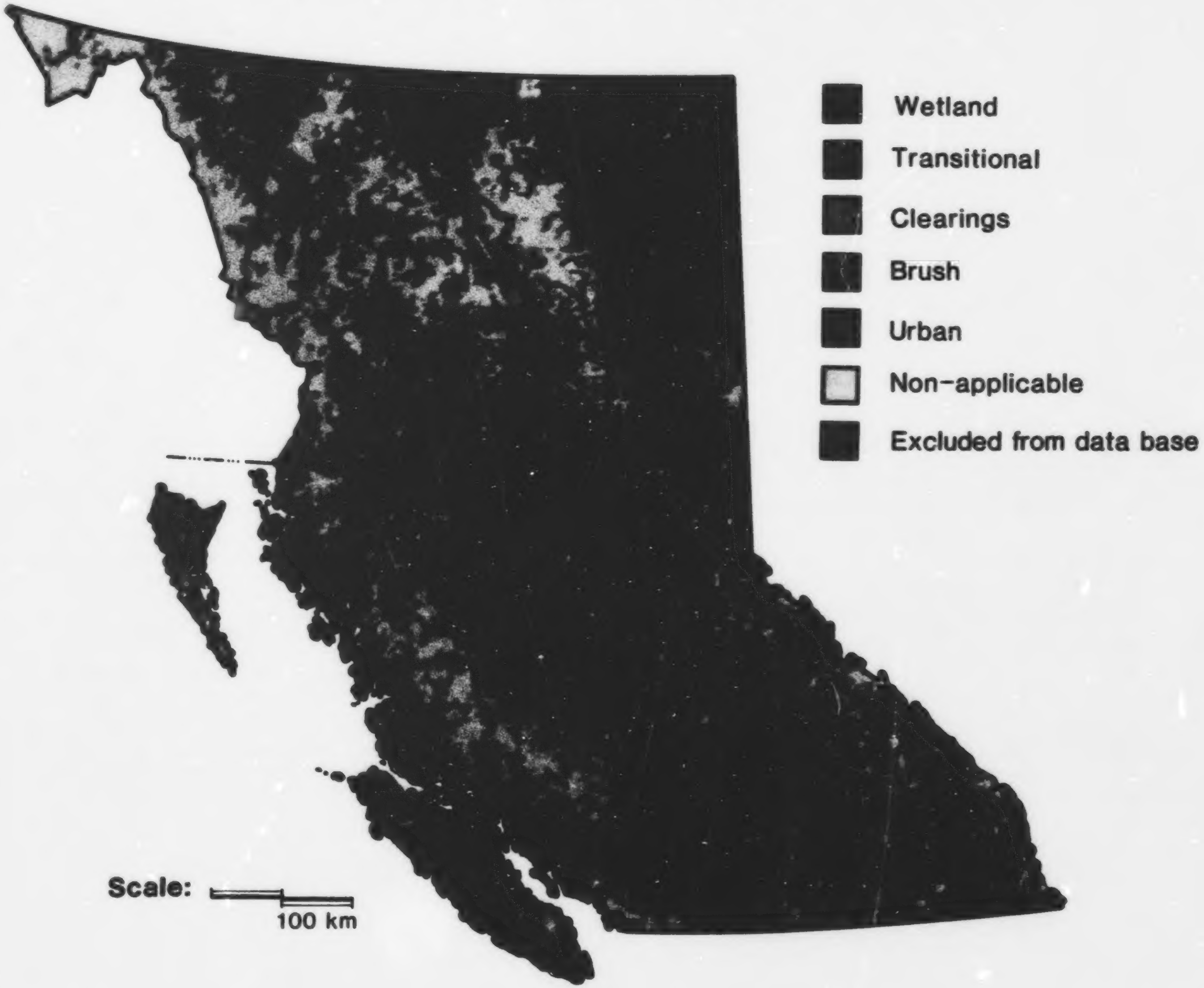

Wetland
Transitional
Clearings
Brush
Urban
Non-applicable
Excluded from data base
Scale:
100 km

FIGURE B-24. RANGE MANAGEMENT UNITS

Figure B-24 illustrates the areas within the 8 Resource Analysis regions where range management is implemented by the Ministry of Forests for livestock and wildlife. With the exception of the northwest corner of the province, Designated Range Management Units include the Crown's forested and nonforested range lands currently being administered by the Range Management Branch. In areas not specifically included in Range Management Units, the Range Management Branch is also responsible for management of forage for wildlife. The large range unit in the northwest corner of the province has some range values for livestock but locations and capacities have not yet been determined.

Within each range unit there are areas which are not utilized by livestock. For example, all of the Kamloops Forest Region is included in Range Management Units. In total, only about 18% of the land area in the Kamloops Forest Region is utilized by livestock. The three General Types from which the most AUMs were harvested by livestock are Dry Forest (17.0, 40.9, 101,407), Transitional (6.3, 54.2, 84,538) and Open Range (1.8, 54.0, 52,213) where the numbers in brackets represent percent of the land area, percent of the General Type utilized by livestock and AUMs harvested respectively.

At the provincial level, only about 10.0% of the land area was utilized by livestock for grazing under permit or licence authorization. The corresponding figures for other regions were Cariboo (26.9%), Kamloops (17.8%), Nelson (5.1%), Prince George Northeast (12.1%), and Prince George (3.6%). Data are not complete for Prince Rupert Interior or Coast. The opportunities to increase the area utilized vary by forest region.

LOCATION OF DESIGNATED RANGE MANAGEMENT UNITS

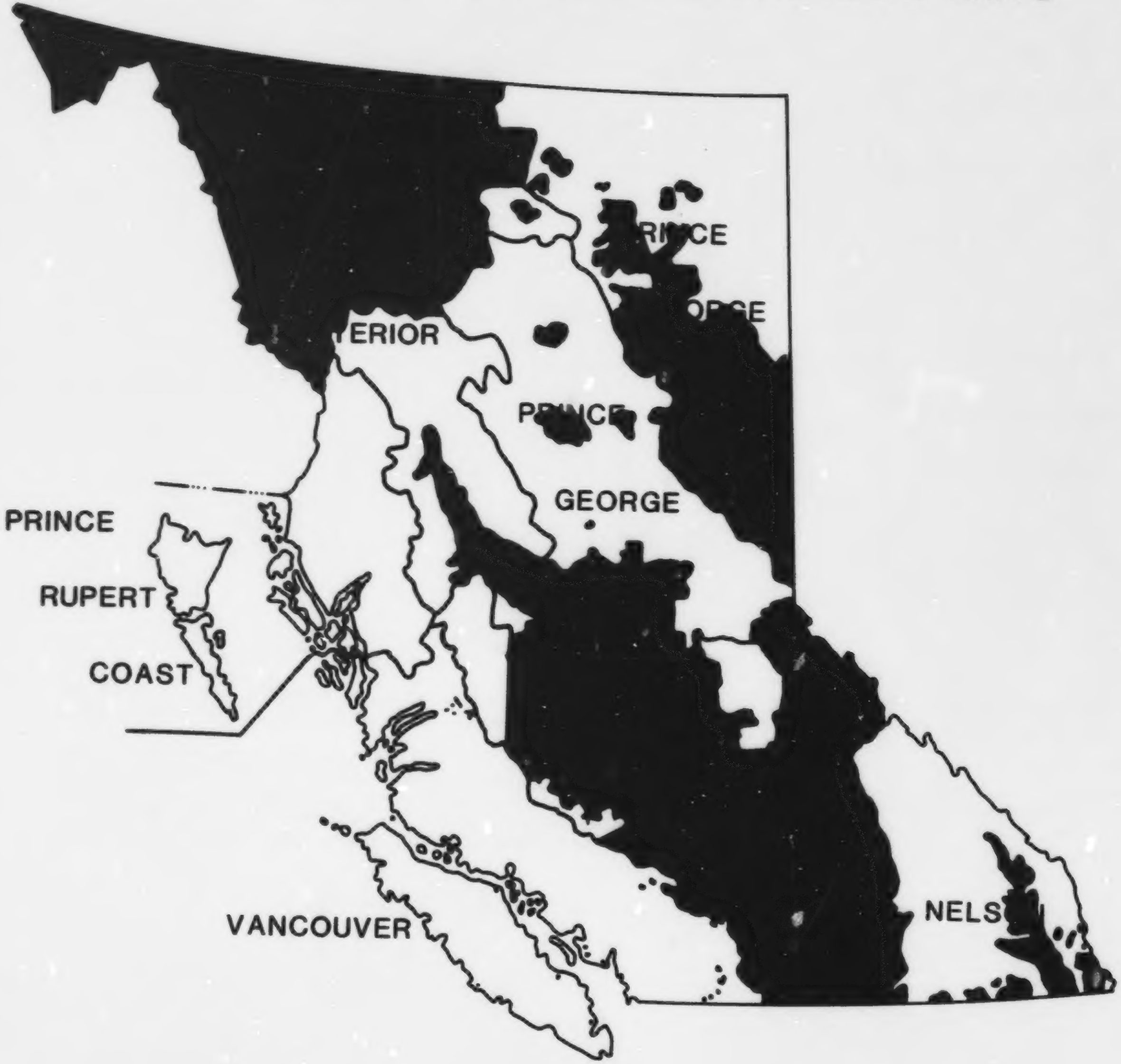
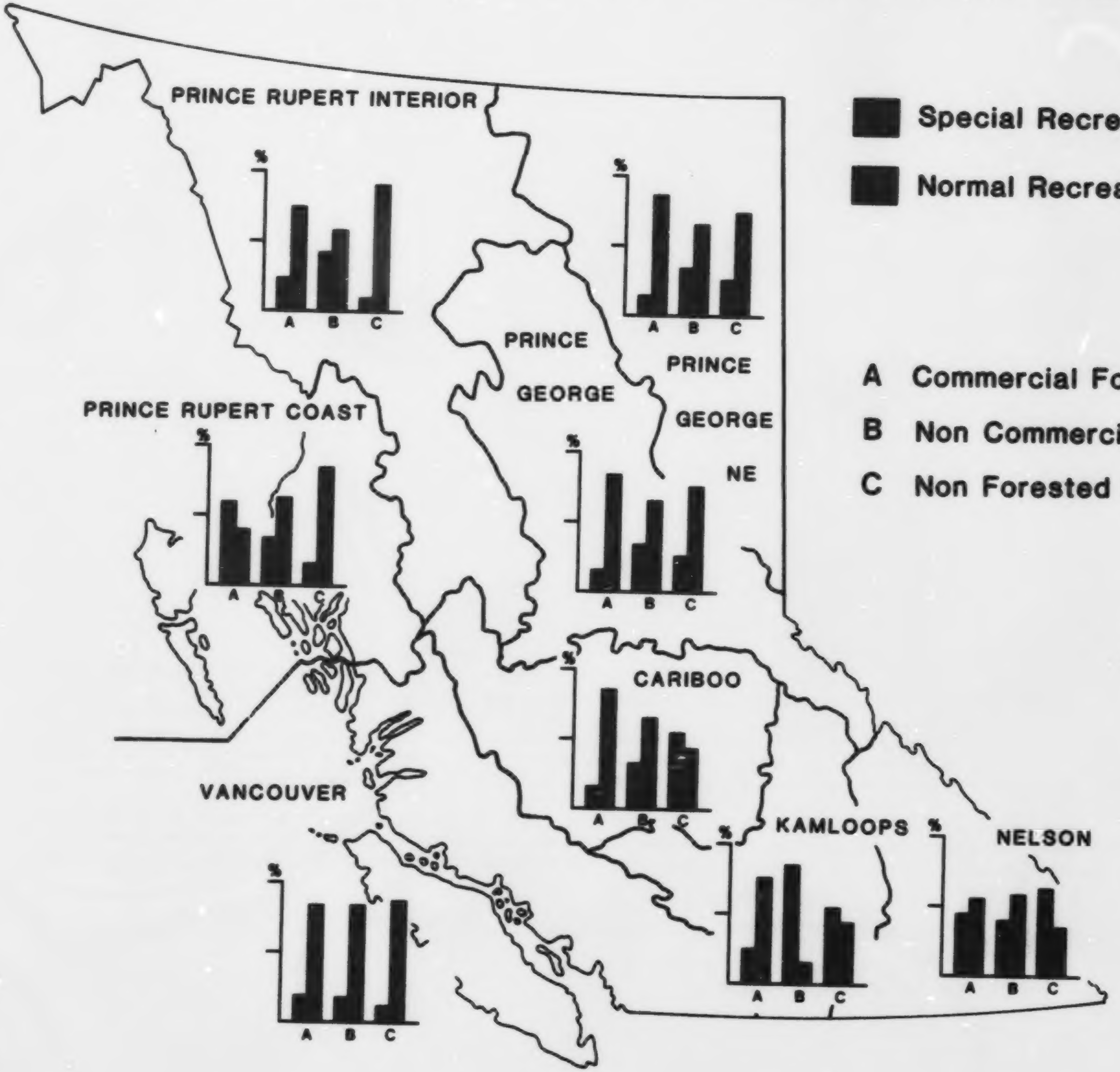

RINCE
ORGE
ERIOR
PRINCE
GEORGE
PRINCE
RUPERT
COAST
VANCOUVER
NELS

FIGURE B-25. FOREST RECREATION - INVENTORY OF RECREATIONAL VALUES

Crown lands (commercial forest land, noncommercial forest land and nonforested land) have been inventoried to illustrate their recreational values and determine which management regime is necessary to best utilize these values. The percentages of total area which, firstly, require special management consideration, and secondly do not require such attention are presented for each of the three land types (A,B and C). These categories total 100% for each land type.

A total of 41.8 million hectares of commercial forest land, 6.9 million hectares of noncommercial forest land and 39.1 million hectares of nonforested land under jurisdiction of the Ministry of Forests are available for recreation.

FOREST RECREATION – INVENTORY OF RECREATIONAL VALUES


PRINCE RUPERT INTERIOR
PRINCE GEORGE
PRINCE GEORGE NE
PRINCE RUPERT COAST
CARIBOO
VANCOUVER
KAMLOOPS
NELSON
%
A
B
C

■ Special Recreation Values

■ Normal Recreation Values

A Commercial Forest Land

B Non Commercial Forest Land

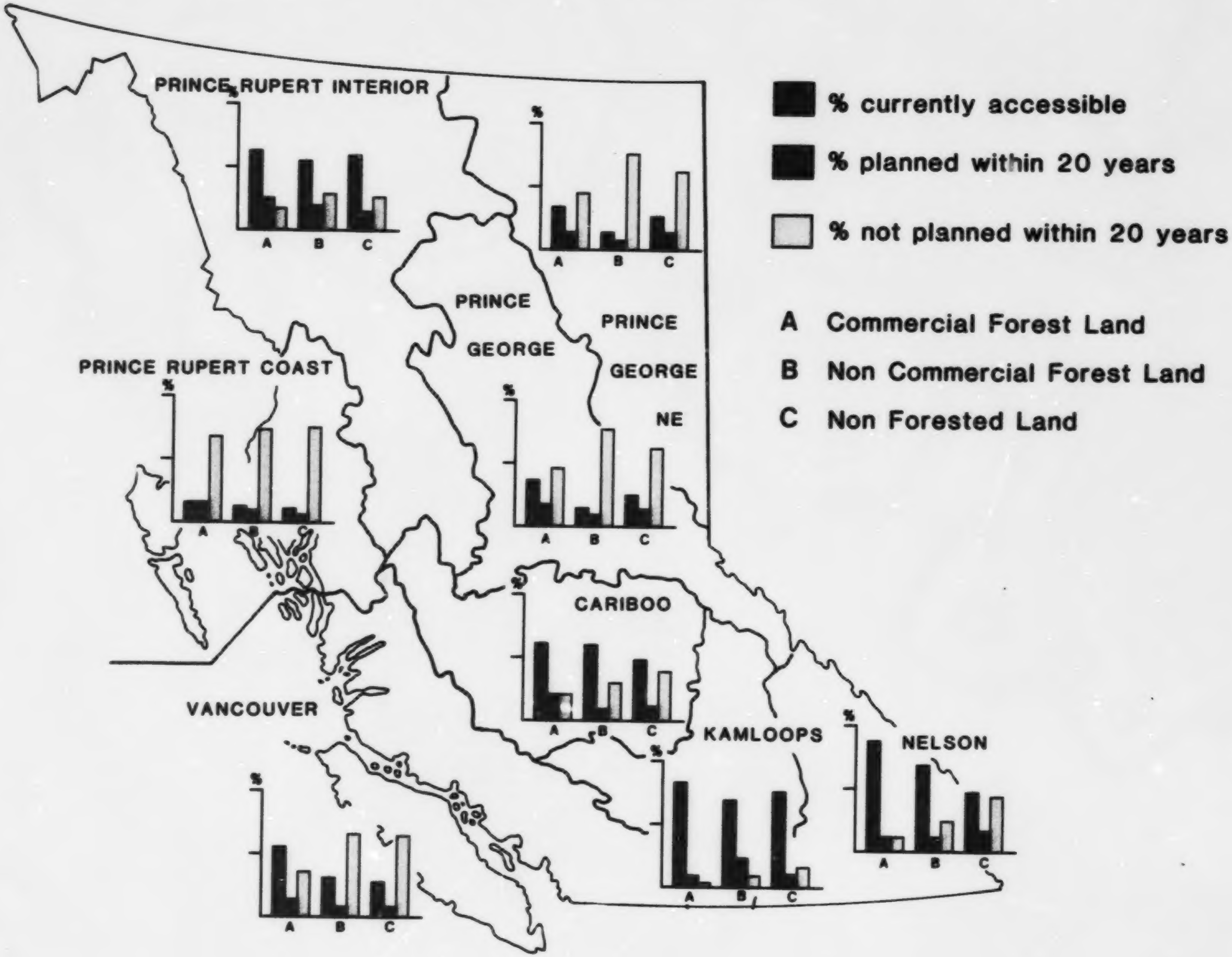
C Non Forested Land

FIGURE B-26. FOREST RECREATION - ACCESSIBILITY BY ROADS

Each of the three Crown land types: commercial forest land, noncommercial forest land and nonforested land have again been inventoried. Figure B-26 illustrates how much of each of these types is currently accessible; planned to be accessible within 20 years; and not planned to be accessible within 20 years.

The map shows accessible areas as a percentage of the total area included in each of the three categories of Crown land as defined by the accessibility constraint. In this context, accessible does not mean that the area can be directly accessed by road. Rather, it means the area is within 8 kilometres of a road that is of at least seasonal, 4-wheel drive vehicle standards and that is in some way connected to the provincial highway system. In addition, to be accessible, the area is generally located within the boundaries of the same watershed where the access road is located.

FOREST RECREATION - ACCESSIBILITY BY ROADS


PRINCE RUPERT INTERIOR
PRINCE GEORGE
PRINCE GEORGE NE
PRINCE RUPERT COAST
CARIBOO
VANCOUVER
KAMLOOPS
NELSON
%
A
B
C

■ % currently accessible

■ % planned within 20 years

□ % not planned within 20 years

A Commercial Forest Land

B Non Commercial Forest Land

C Non Forested Land

SECTION C

CONDITION OF THE RESOURCES

The province's forest and range resources are prime contributors to our economic and social prosperity. While these resources have considerable value and are generally renewable, they are neither inexhaustible nor immune to damage and neglect. In this section, the condition of the timber, range and recreation resources is assessed.

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CHAPTER C1

CONDITION OF THE TIMBER RESOURCE

This chapter reviews the condition of the timber resource. It includes information on sources of denudation, reduced productivity and increased productivity.

SOURCES OF DENUDATION

Harvesting and wildfire are the main sources of denudation, consuming a total of 68 million m³ annually. Statistics on volumes and areas harvested are presented below followed by statistics on volumes and areas lost to wildfire.

HARVESTING

Figure C-1 depicts the proportion of the harvest taken from each of the Ministry of Forests' administrative regions. The supporting data shows the average volume billed and the average area harvested between 1976 and 1984. Averages are used to smooth out the large annual fluctuations resulting from the effects of markets on harvesting levels.

The volume statistics used in the figure and in the first table include all harvesting on Crown, private, federal and Indian Reserve land. The area statistics used in the second table include all Crown forest land, but only that part of private forest land that is included within tenures issued by the government, such as tree farm and woodlot licences. As indicated in the tables, an average of approximately 71 million m³ was billed each year and approximately 176,000 hectares harvested.

Eighty-five percent of the annual denudation is through clearcut logging; the remainder through selective logging.

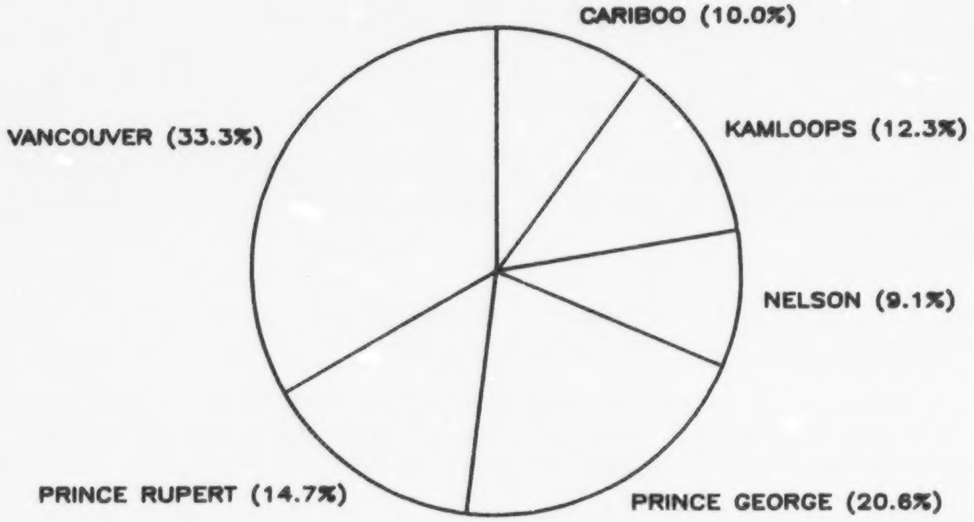
WILDFIRE

Figure C-2 depicts the proportion of the total volume lost to wildfire in each Ministry of Forests administrative region. The accompanying data show that the average volume lost and area denuded by wildfire each year between 1974 and 1983 are approximately 4 million m³ and 50,000 hectares. Averages are used to smooth out the large annual fluctuations resulting from the effects of weather on wildfires. The statistics on the areas burned do not include range lands, not satisfactorily restocked lands, noncommercial brush and nonproductive areas, but they do include all other areas.

Figure C-1

ANNUAL VOLUME BILLED

AVERAGE BY REGION: 1978–1984



AVERAGE ANNUAL VOLUME BILLED -CLEARCUT & SELECTIVE LOGGING*

REGION	1978-79**	1979-80**	1980-81	1981-82	1982-83	1983-84	AVERAGE
			Thousands of m3				
CARIBOO	7469	6504	7347	6518	7283	7566	7115
KAMLOOPS	8908	8813	8437	9592	7282	9131	8694
NELSON	7255	6904	6350	5465	5649	6993	6436
PRINCE GEORGE	13927	15985	13131	12608	14124	17669	14574
PRINCE RUPERT	9424	11527	12152	10351	7978	11271	10451
VANCOUVER	28190	26462	25167	18091	18626	25078	23602
TOTAL	75173	76195	72584	62625	60942	77708	70871

*Includes firmwood rejects.
Includes all harvesting on Crown, private and federal lands and Indian Reserves.
**Calendar year equivalent (ie. 1978 = 1978-79)

AVERAGE ANNUAL AREA HARVESTED -CLEARCUT & SELECTIVE*

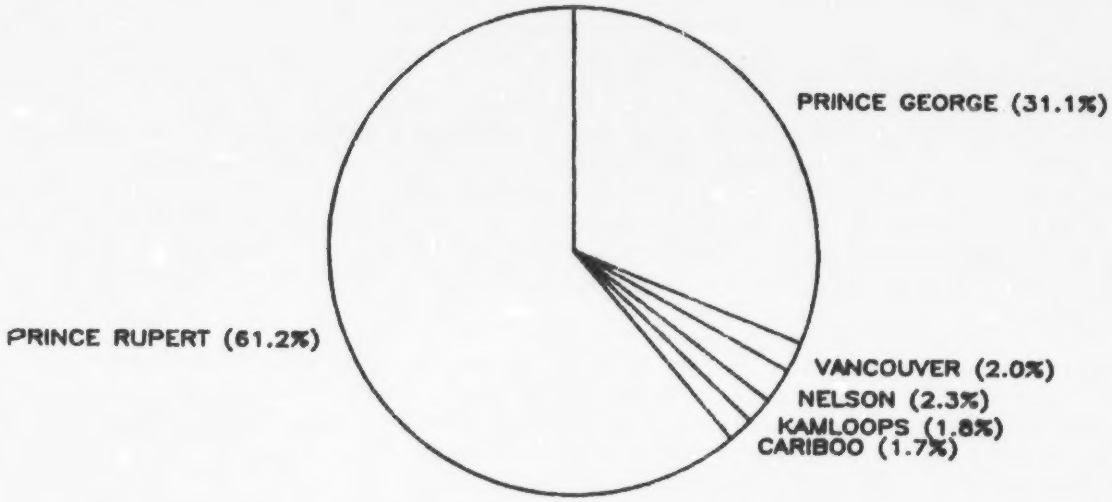
REGION	1978-79**	1979-80**	1980-81	1981-82	1982-83	1983-84	AVERAGE***
			(ha)				
CARIBOO	26600	28537	33008	23978	29959	27935	28300
KAMLOOPS	24727	25835	26408	19894	21942	30182	24800
NELSON	19592	22261	22405	15739	20064	19877	20000
PRINCE GEORGE	39310	62644	46234	48122	43648	62590	50400
PRINCE RUPERT	21774	25284	28126	19131	21026	25186	23400
VANCOUVER	34142	31972	31653	21025	25533	32716	29500
TOTAL***	166100	196500	187800	147900	162200	198500	176500

*Includes all Crown land harvested and private land within government-issued tenures such as TFL's TF's & Woodlots.
For consistency with earlier data, 1983-84 annual report data has been adjusted to exclude 'Other Private Land'.
**Calendar year equivalent (ie. 1978 = 1978-79)
***Rounded

Figure C-2

ANNUAL VOLUME LOST TO WILDFIRE

AVERAGE BY REGION: 1974–1983



AVERAGE ANNUAL VOLUME LOST TO WILDFIRE
10-YEAR PERIOD: 1974-1983

REGION	IMMATURE m3	MERCH.* m3	TOTAL** m3
CARIBOO	28010	44920	72900
KAMLOOPS	14815	62175	77000
NELSON	12230	88219	100400
PRINCE GEORGE	398349	965637	1364000
PRINCE RUPERT	438367	2246297	2684700
VANCOUVER	33629	53930	87600
TOTAL**	925400	3461200	4386600

* Merch. volumes are net after salvage estimates
**Totals rounded

AVERAGE ANNUAL AREA BURNED BY WILDFIRE *
10-YEAR PERIOD: 1974-1983

REGION	IMMATURE HA	MERCH. HA	TOTAL** HA
CARIBOO	469	1008	1500
KAMLOOPS	271	795	1100
NELSON	154	506	700
PRINCE GEORGE	6820	12319	19100
PRINCE RUPERT	9527	16272	25800
VANCOUVER	201	447	600
TOTAL**	17400	31300	48800

*Excludes 'other' area such as NSR, Range & NP lands
**Totals rounded

SOURCES OF LOST PRODUCTIVITY

PESTS

Figure C-3 shows that approximately 28 million m³ are lost to insects, disease and decay. The figures are for the gross loss and do not account for salvaged timber. Therefore, the net loss will be less.

DECADENT AND STAGNANT STANDS

No specific surveys have been conducted to determine the extent of decadent or stagnant timber. On the basis of inventory listings and professional judgement, estimates place the area of decadent and stagnant stands at about 3.2 million hectares and 2.0 million hectares, respectively, which amount to about 13% of the mature and immature productive forest. Figure C-4 depicts what proportion of the total area occupied by such stands is found in each region.

Decadent stands consist of mature timber, either growing very slowly or reducing in volume from decay and for which there are no present or anticipated timber values within the next ten years. Some of this material can be used for pulp, reconstituted board and panel products, or energy. Hollow shells of decadent cedar have also been used for sawn specialty products or shakes and shingles. Harvesting and transportation costs are similar to those for sound wood, but because of abundant sawmill residues, only the most accessible is used.

Many of these stands occupy productive forest land but require a major program of site rehabilitation, felling, piling or bunching and burning in order to remove the standing timber and replace it with young conifer seedlings.

Stagnant stands consist of immature timber growing very densely and usually result from wildfires. They are not expected to become merchantable without major intervention such as juvenile spacing or, in severe cases, total elimination and renewal by planting.

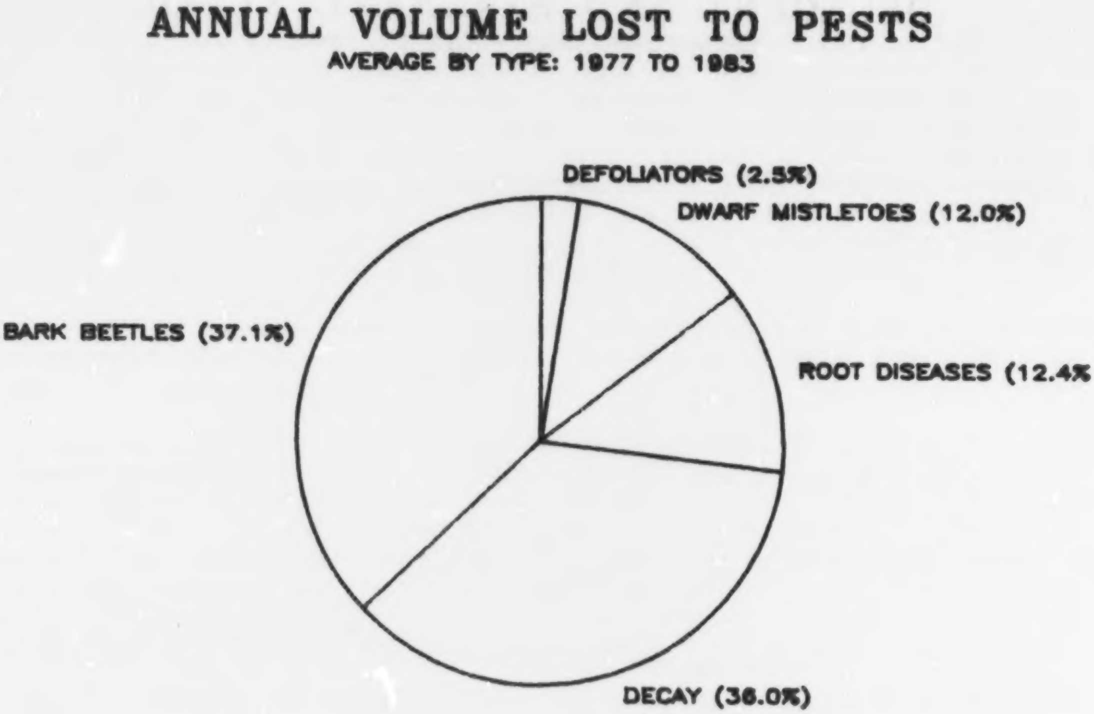
No specific programs are in place to deal with decadent or stagnant sites, although some site rehabilitation treatments are conducted on locally identified areas.

NOT SATISFACTORILY RESTOCKED (NSR) FOREST LAND.

Not satisfactorily restocked forest land, in the silvicultural sense used here, is land on which stocking is below a specified minimum or is not stocked with species that optimize the site's commercial productivity. It also includes for the purposes of this discussion, disturbed areas for which status has not been determined (DSD - Disturbed-Stocking Doubtful) and areas that have reverted to brush but could be rehabilitated (NCBr - Noncommercial Brush).

The extent of NSR forest land is one of the more controversial land management issues and has a direct bearing on the sustainable harvest level. The contribution of NSR areas to the long-term productivity of the land base

Figure C-3

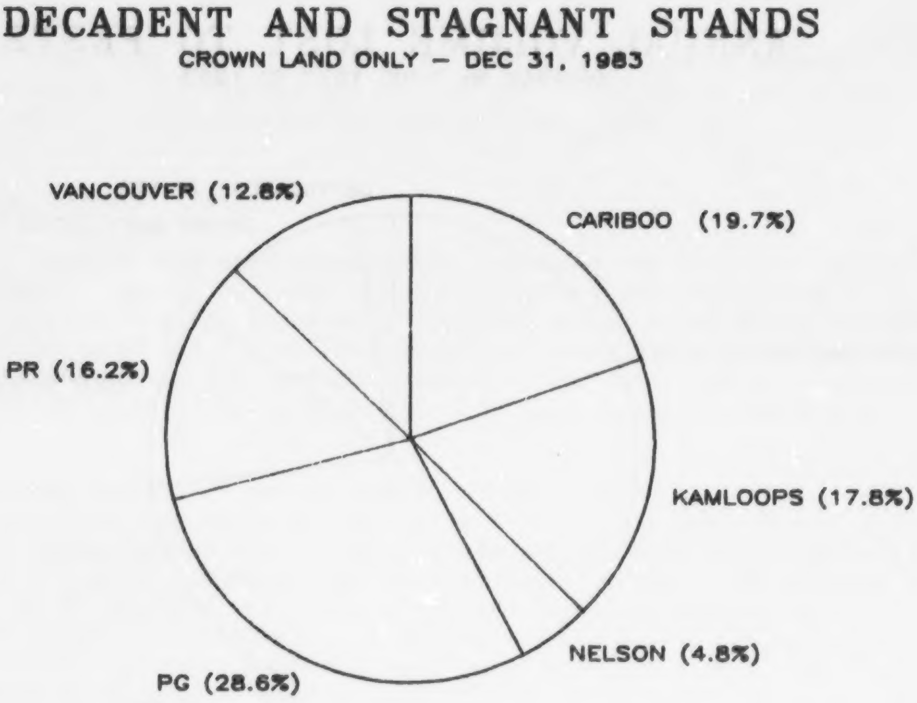


ANNUAL VOLUME LOST TO PESTS*
PERIOD: 1977-1983

PEST TYPE	m3
DEFOLIATORS	696000
DWARF MISTLETOES	3340000
ROOT DISEASES	3440000
DECAY	10000000
BARK BEETLES	10310000
TOTAL	27786000

*Data collected by the Canadian Forestry Service on a Provincial basis only and covers all lands in B.C..
Loss figures are gross, with no reduction for salvage

Figure C-4



DECADENT AND STAGNANT STANDS
CROWN LAND ONLY - Dec. 31, 1983

REGION	DECADENT	STAGNANT	TOTAL*
	Hectares		
CARIBOO	216181	812951	1029100
KAMLOOPS	511485	422562	934000
NELSON	167562	84896	252500
PG	1101028	398729	1499800
PR	637824	211543	849400
VANCOUVER	560289	111614	671900
TOTAL*	3194400	2042300	5236700

*Rounded

depends on the expected mix of natural and artificial regeneration, regeneration delay and the level of silvicultural investment approved in the Ministry's Five-Year Forest and Range Resource Program.

Regeneration delay is the elapsed time between denudation and restocking. Planted sites are assumed to have a regeneration delay of zero or ten years for the purpose of yield calculations. (Computer models currently used by the ministry are intentionally restricted to calculating regeneration delay in ten-year increments to reduce the number of computer runs required and to minimize costs.) This is an overly optimistic assumption in the short term but has a minimal impact on timber supply area yield analyses, which commonly project forest growth over a period of 200 years. Sites that require planting, but for which no funding is available, may be assigned a delay period as long as 30 years, depending on site conditions.

All sites will regenerate eventually but, if a return to satisfactory stocking is not expected within 30 years, a site will be classified as nonproductive and excluded from yield calculations.

In addition to determining allowable annual cuts, NSR statistics are used to review government and industry performance in programs related to the protection and maintenance of the resource base.

NSR types currently cover about 1.6 million hectares of Crown land, when factored or adjusted for expected regeneration.

Changes in NSR since the 1979 Resource Analysis

Within the Ministry of Forests, NSR statistics come primarily from three sources: the Inventory Section of the Planning and Inventory Branch; the Silviculture Branch, which maintains the History Record System; and regional planning officers.

Inventory records cover all Crown land in the province and are based on aerial surveys supported by ground sampling. The historical records produced by Silviculture Branch are generally confined to sampled areas. This difference in survey techniques has resulted in a large difference in the amount of land classified as NSR within each system: 1.3 million hectares in the History Record System versus 3.4 million hectares in the inventory system. Both figures exclude tree farm licence data, which is submitted to the ministry separately by individual licensees.

Their terminology also differs in that the Inventory Section considers areas of deciduous species and unevenly distributed coniferous species to be satisfactorily stocked only if they contain acceptable tree species and meet certain standards regarding the number of stems per hectare and the uniformity of their distribution. Stocking guidelines vary from one forest region to the next and may vary within each forest region based on site specific considerations such as ecological classification, preferred and acceptable species, regeneration delay and end product objectives.

And, finally, their methods differ: Silviculture Branch applies additional factors to take into account expected natural regeneration on unsurveyed or infrequently surveyed land, which substantially reduces the area listed as NSR.

To represent the provincial NSR situation as accurately as possible, inventory data has been modified to reflect the forest management criteria applied to silvicultural ground (regeneration) surveys. This involved dividing inventory data into NSR-current and NSR-backlog categories using the proportions found in the history record system and applying regeneration factors. (NSR-current includes land on which the accepted regeneration period has not elapsed. That is, roughly three years on the coast and five years in the interior; NSR-backlog includes land that is not satisfactorily restocked after the specified regeneration period has expired). The regeneration factors were derived from historical regeneration survey data and range from .25 to .60 (i.e. 75% to 40% of areas classified as NSR are expected to be stocked). On average, about 50 percent of all NSR lands and 40 percent of the good and medium site NSR lands turn out to be stocked upon field inspection. That is, they are incorrectly classified as NSR.

NSR forest land is a dynamic medium with continuous inflows and outflows resulting from restocking through natural and artificial regeneration and the denudation of other areas through logging and wildfires. NSR statistics can, therefore, only reflect the situation at a specific point in time, with periodic updates required as new areas are sampled and others are resurveyed. It is not currently feasible or cost effective to sample all areas annually, although estimates of the changes occurring on unsurveyed areas can be made by using the regeneration factors described earlier.

Changes and improvements in survey techniques, sampling methods, access management criteria and the increased magnitude of survey coverage has given us a much clearer picture of the current state of our forest resources. These same improvements, however, have made it difficult to compare current assessments with previous assessments of forest productivity and thus to determine changes over time.

For the 1979 Resource Analysis, NSR/DSD/NCBr statistics were compiled on the basis of Silviculture Branch History Records, inventory data where historical records were lacking, and local knowledge. This information was submitted by each forest district and tree farm licence holder and collated by a Resource Analysis task force. The total provincial NSR amounted to 1.9 million hectares with 0.6 million hectares on good and medium sites (factored to allow for expected regeneration).

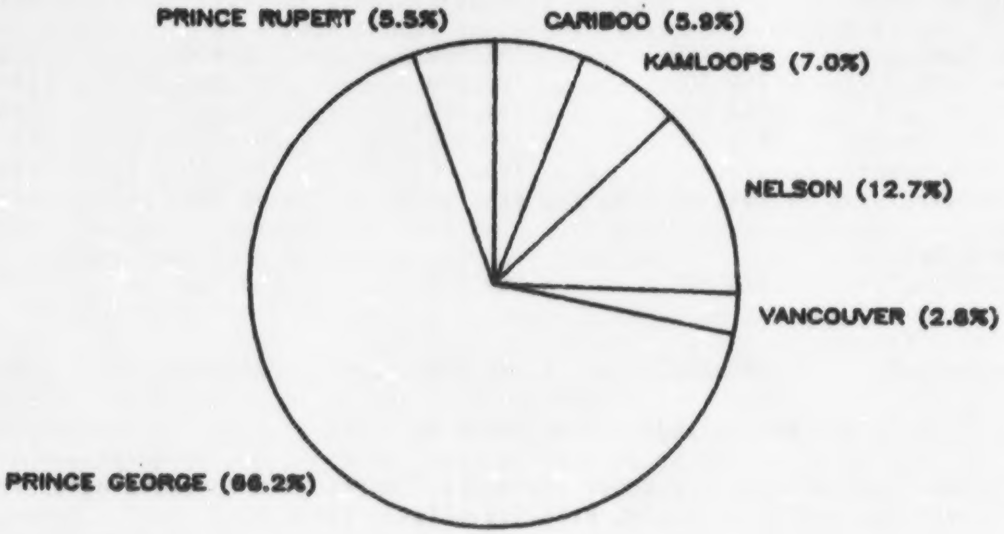
These same statistics were compiled for the 1984 Resource Analysis using inventory data, with current backlog breakdown and regeneration factors determined from History Record data. Tree farm licence holders again submitted their own information. The total provincial NSR calculated by this method amounts to 3.6 million hectares with 0.7 million hectares on good and medium sites (factored to allow for expected regeneration). Table C-1 shows the 1979 and 1984 figures. Figure C-5 shows the proportion of NSR land found in each region.

The 1.6 million hectare, or 85%, increase over five years is due mainly to the inclusion of survey data from remote northern portions of the Prince George and Prince Rupert Forest Regions, with the majority of the increase in poor and low sites. Growth projections on these and other poor and low sites in the province indicate that the returns on forest management investments are expected to be minimal or nil. Accordingly, only good and medium sites are

Figure C-5

NSR/DSD AND NCBr AREA BY REGION

GOOD & MEDIUM SITES ONLY: Dec. 31,1983



NSR/DSD & NCBr AREA BY REGION*
GOOD & MEDIUM SITES ONLY: Dec.31, 1983

REGION	BACKLOG	CURRENT	NC Br	TOTAL**
		Hectares		
CARIBOO	20863	21110	1377	43400
KAMLOOPS	20971	26180	4252	51400
NELSON	39187	22775	31762	93700
PRINCE GEORGE	82980	57267	348419	488700
PRINCE RUPERT	12698	14605	13166	40500
VANCOUVER	10320	8180	1771	20300
TOTAL**	187000	150100	400700	738000

*Factored for expected regeneration

**Totals rounded

considered to be economically treatable; the increase in this component of NSR lands on these sites amounts to 365,000 hectares (42%) but after factoring the increase is only 93,000 hectares, or 14%.

Table C-1. Area of NSR/DSD/NCBr On Crown Land, TFLs and Timber Licences (hectares)

Forest Region	All Sites 1979	All Sites 1984	Good & Medium Sites Only 1979	Good & Medium Sites Only 1984
Cariboo	174,400	158,900	110,400	100,800
Kamloops	150,400	193,600	107,000	141,000
Nelson	262,800	244,000	174,200	156,800
Prince George	823,700[3]	2,142,800[2]	292,400	632,700
Prince Rupert	419,100	703,000[3]	98,500	120,300
Vancouver	94,300	111,500	80,500	77,600
Total before factoring*	1,924,600	3,553,900	864,000	1,229,200
Total after factoring*	1,095,200[4]	1,634,500	644,600	737,900

* Totals may not add due to rounding.

1 The regional data are gross inventory figures before regeneration factors were applied to allow for expected natural stocking.

2 Prince George figures for 1979 included some Peace River data that had already been factored.

3 The large increases in Prince Rupert and Prince George result from more detailed surveys in remote northern areas. Over three-quarters of the increase is in poor and low sites.

4 Reflecting minor 1982 adjustments.

Averaged over the five-year period since the 1979 Resource Analysis, this increase in NSR translates to a loss of 19,000 hectares per year or 9% of the area logged and burned annually. These figures do not include area lost to land alienation (parks, hydro reservoirs and rights-of-way, urban settlement, mining), environmental concerns or denuded poor and low sites not scheduled for planting.

History Records for the period 1979 to 1983 indicate that at least 80,000 hectares of forest land scheduled for planting were not planted and were still classed as NSR by the end of 1983. Also, of the sites that were planted, only 50% were planted within the recommended period following denudation. These shortfalls resulted from a lack of available or appropriate planting stock or operational problems such as drought, excessive rain, restricted access, inadequate site preparation, etc.

In addition to those areas scheduled for planting but not planted, other areas could have reverted to, or retained, NSR status because of plantation failure or unforeseen delays in natural regeneration. This may partially explain the difference between the 80,000 hectare increase in NSR determined from the History Records and the 93,000 hectare increase in NSR indicated by survey data. Nonetheless, the figures are remarkably close and can be considered a reasonably accurate assessment of the increase in NSR since the 1979 Resource Analysis.

The average growth rate of immature forests on good and medium sites in the province expressed as a mean annual increment is approximately 3 m^3 per hectare. Thus, if the approximately 738,000 hectares of good and medium site NSR were immediately restocked with commercial forest crops, the increase in net annual growth (close utilization less decay) would amount to 2.2 million m^3 per year. This growth translates into 3% of the current annual allowable cut of 70.1 million m^3 per year from regulated lands including tree farms, assuming that all of this area is available for continued forest management and that no growth would have occurred on these areas without some form of management intervention.

Under Section 52(a) of the Forest Act, where a licensee applies silvicultural treatments to Crown land in addition to the treatments required under the licence, the licensee may receive an increase in the allowable annual cut equal to the gain in productivity attributable to those treatments. This is known as the allowable cut effect and applies to the regeneration of unproductive lands as well as to increases in the harvestable volume of established stands achieved through intensive forest management. Thus, if silvicultural treatments were applied to immediately restock good and medium site NSR lands with commercial forest crops, an appreciable increase in the provincial allowable annual cut could be realized. Individual licensees engaged in this activity would be awarded an increase in their own harvesting rights according to a schedule specified in ministry policy. To date, only two companies, both located in the Vancouver Region, have received increases related to this section of the Forest Act.

Brushing Problems

Of the good and medium site NSR forest land in the province, the majority are encroached upon, or overtaken by undesirable woody plants and noncommercial tree species. These lands are of special concern as they include some of the best growing sites in the province and are among the most expensive to rehabilitate. Brushing problems also exist on areas currently classified as satisfactorily restocked (SR) but where extensive brushing and weeding or conifer release programs are required to maximize their growth potential.

A comprehensive report on this subject was released in the spring of 1984 by the Silviculture Branch. It estimates brushing problems exist on 2.9 million hectares of good and medium site NSR/DSD/NCBr, deciduous and SR types, with close to 49,000 hectares expected to be added annually in the absence of an adequate vegetation management program. About 42% of the good and medium site current NSR, 66% of the good and medium site backlog NSR and 100% of the good and medium site noncommercial brush areas require treatment.

Growth losses on forest lands invaded by brush are estimated to exceed 8 million m^3 per year, increasing at a rate of 0.2 million m^3 per year. These figures are somewhat inflated, however, as they include some overlap with previous projections of growth losses on NSR lands and assume total mean annual increment losses on all brushed-in sites although some growth will almost certainly occur where commercial species are established.

Management techniques to minimize brush problems on recently denuded areas include appropriate harvesting systems, immediate site preparation and planting with quality planting stock. Techniques used to treat an area following brush invasion are usually more expensive and involve manual or mechanical clearing, herbicide application and the use of prescribed fire prior to planting.

SOURCES OF INCREASED PRODUCTIVITY

Basic and intensive silviculture treatments are designed to restock recently denuded lands and lands denuded in the past as well as to enhance the productivity of underproductive and immature stands of timber. The ultimate impact of these activities will be on timber harvest rates as the amount of timber available for harvest in the future is maintained or gradually increased.

BASIC SILVICULTURE

Activities designed to monitor, restock and maintain the productivity of recently denuded forest lands fall into the category of basic silviculture, which includes site preparation, planting, seeding, brushing and weeding, and various types of surveys.

Site Preparation

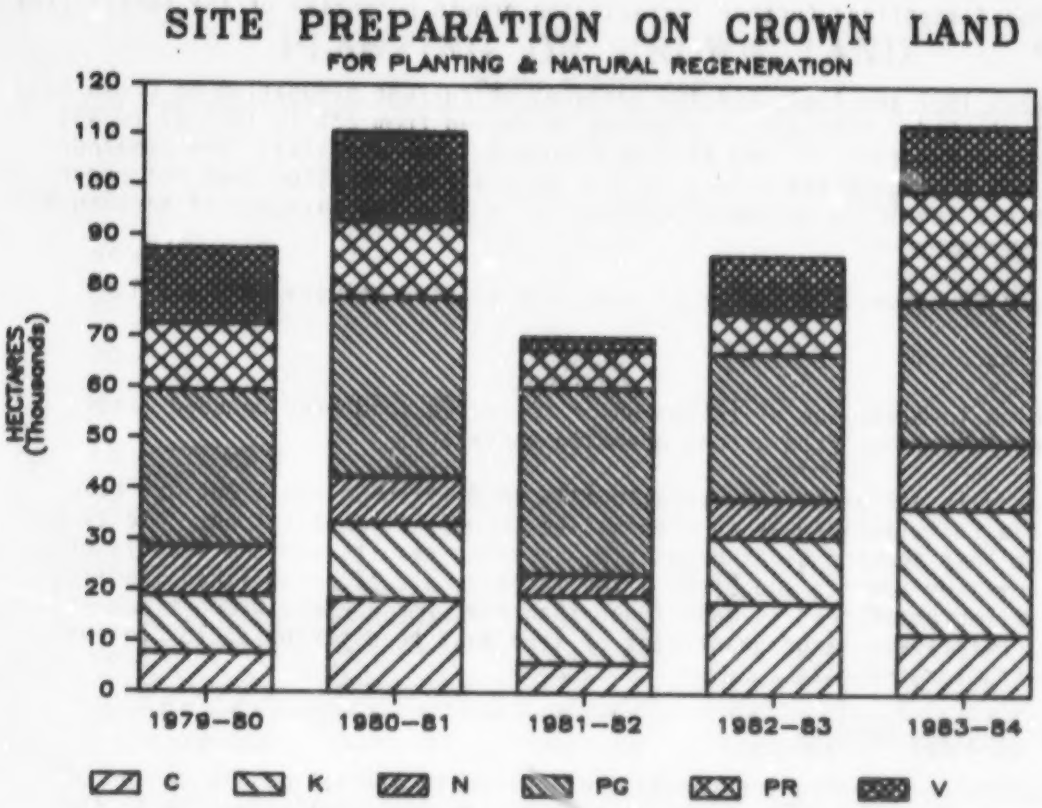
Site Preparation is required on sites where logging slash, grass, brush or thick layers of organic matter are preventing natural seedlings from becoming established or would impede the successful planting of nursery-grown seedlings. Preparatory treatments include broadcast burning, piling and burning, mechanical scarification or the use of specialized machinery to prepare individual planting spots.

During the period between 1979 and 1984, site preparation was conducted on 467,400 hectares of Crown land (see Figure C-6).

Basic Planting

Basic planting involves planting nursery-grown seedlings on recently denuded areas not expected to regenerate naturally within an acceptable period of time. All forest land will restock eventually, depending on the tree species involved, geographic location and natural productivity of the forest land. A few years to many decades may elapse, however, before commercially valuable trees reappear. Excessive regeneration delays and slower growth rates will result in longer rotations and a significantly reduced yield of commercially valuable timber over a given period of time.

Figure C-6



SITE PREPARATION FOR PLANTING & NATURAL REGENERATION
CROWN LAND ONLY

REGION	1979-80*	1980-81	1981-82 (Hectares)	1982-83	1983-84	TOTAL**
CARIBOO	7722	18365	5892	17951	11897	61800
KAMLOOPS	11320	14830	13249	12804	24902	77100
NELSON	9560	9271	4300	7593	12720	43400
PG	30647	35329	36559	28736	28186	159500
PR	13309	15151	7517	8004	21680	65700
VANCOUVER	15000	17760	2661	11332	13105	59900
TOTAL**	87600	110700	70200	86400	112500	467400

* Includes Site Preparation for Hazard Abatement (with the exception of Landings Burned)

**Rounded

Planting increases the commercial productivity of forest land by reducing or eliminating restocking delays and by ensuring that trees are distributed uniformly so that more forest land is producing timber. Genetically improved seedlings further increase the growth potential of the forest land base.

Between 1981 and 1984, 214,100 hectares of current denudation on Crown land were planted. The rate of planting increased from 27% in 1981-82 to 45% of annual denudation in 1983-84 (see Figure C-7 for details). The remainder is left to regenerate naturally. If natural regeneration does not occur within a specified period of time it falls into the category of backlog NSR land.

Figure C-8 shows the number of seedlings planted between 1979 and 1984.

Seeding

Seeding involves the distribution of collected seed over denuded lands, either by air or from ground operated spreaders.

Seeding is not practised operationally in British Columbia but has been tested for viability as an alternative reforestation treatment. Tests have shown that seeding gives uncertain, variable results and the seed is often consumed by rodents and birds. The success rate of established seedlings per kilogram of seed is much lower than that for nursery grown stock and thus relatively large quantities of seed must be distributed to achieve satisfactory results.

Brushing and Weeding

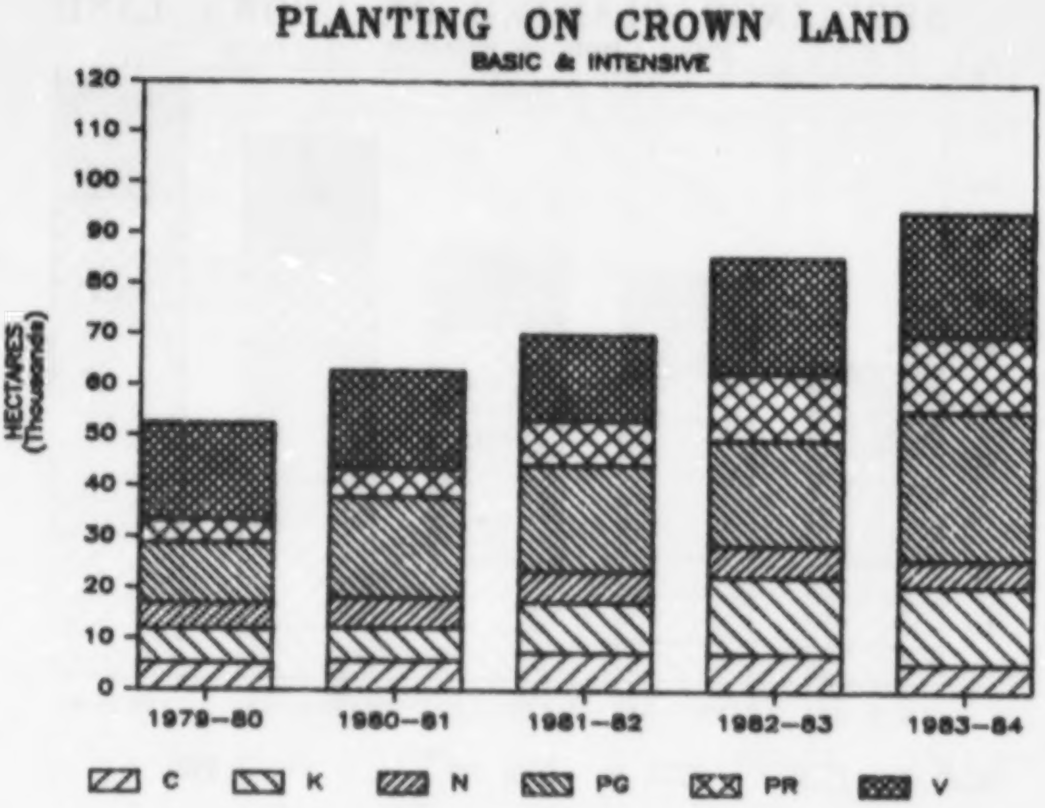
Brushing and weeding treatments are applied to plantations in danger of encroachment by brush. These treatments involve manual clearing or the application of herbicides until a stand reaches the "free-growing" stage at which point it is growing above the surrounding vegetative competition. Brushing and weeding treatments are not usually required for stands over ten years of age. Treatments required to reduce competition from deciduous tree species at a later stage are referred to as conifer release and come under the category of intensive silviculture.

Brushing and weeding treatments were conducted on 17,800 hectares of Crown forest land between 1979 and 1984 (see Figure C-9 for details).

Surveys

To determine the need for basic and intensive silvicultural treatments and to monitor their results, regeneration and survival surveys are conducted annually. Regeneration surveys of unplanted areas were conducted over 587,700 hectares between 1981 and 1984. On average about 60% of the area surveyed was classified as satisfactorily stocked. Surveys of ministry and licensee plantations (one to three years after planting) were conducted over 314,200 hectares during the same period and 80% of the area was classified as satisfactorily stocked (SR). The total area surveyed (plantations and natural restocking on current and backlog lands) between 1979 and 1984 amounted to some 1,344,100 hectares.

Figure C-7

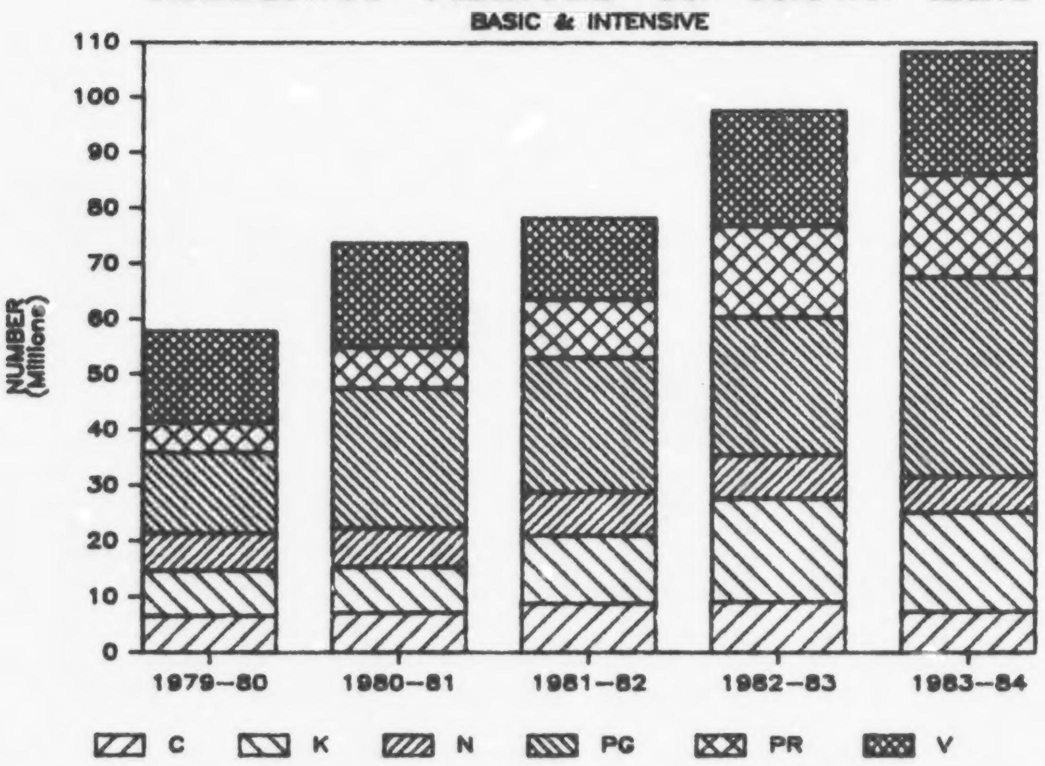


ANNUAL AREA PLANTED ON CROWN LAND
BASIC & INTENSIVE

REGION	1979-80	1980-81	1981-82 (Hectares)	1982-83	1983-84	TOTAL*
CARIBOO	5351	5772	7514	7419	5483	31500
KAMLOOPS	6671	6483	9984	15073	15336	53500
NELSON	5119	5907	6103	6132	5352	28600
PG	11821	19775	20805	20837	29257	102500
PR	4567	5590	8787	13225	14912	47100
VANCOUVER	19014	19356	16986	22907	24388	102700
TOTAL*	52500	62900	70200	85600	94700	365900

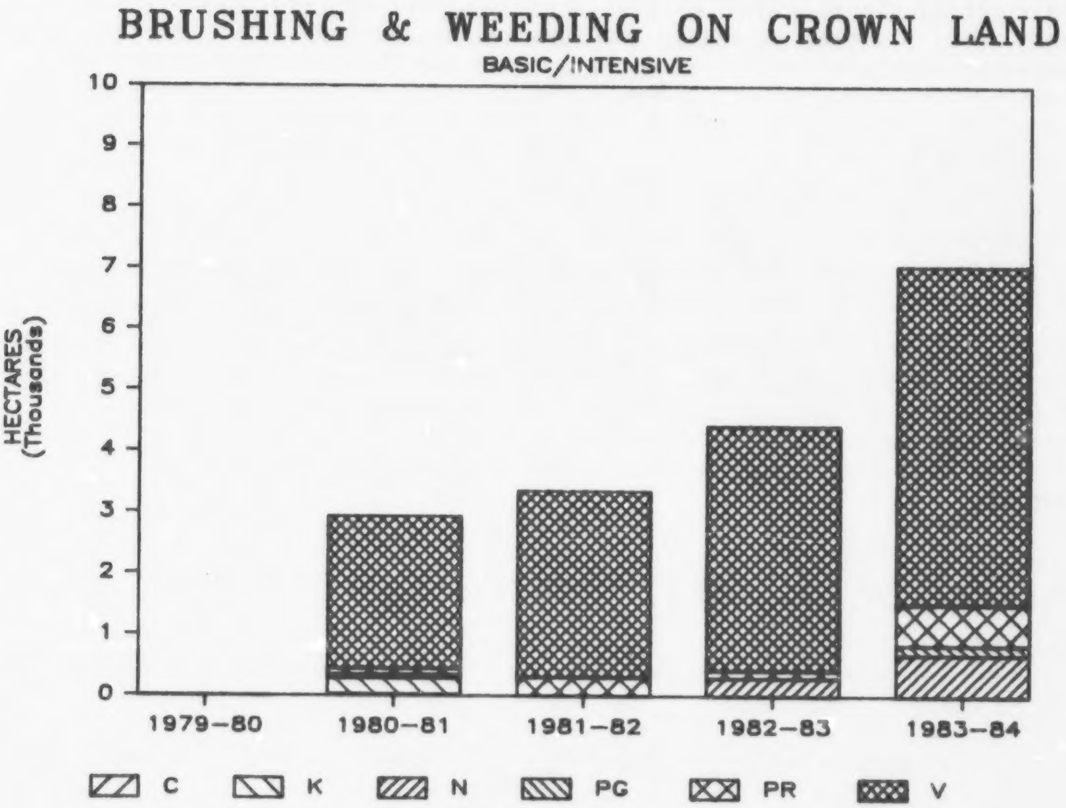
*Rounded

Figure C-8



SEEDLINGS PLANTED ON CROWN LAND BASIC & INTENSIVE						
REGION	1979-80	1980-81	1981-82	1982-83	1983-84	TOTAL
			(Thousands)			
CARIBOO	6603	7193	8839	9090	7413	39138
KAMLOOPS	8174	8267	12218	18637	17834	65130
NELSON	6715	6895	7819	7850	6425	35704
PG	14431	25212	24178	24868	35946	124635
PR	5405	7425	10506	16420	18568	58324
VANCOUVER	16644	18787	14785	20809	22188	93213
TOTAL	57972	73779	78345	97674	108374	416144

Figure C-9



REGION	1979-80	1980-81	1981-82	1982-83	1983-84	TOTAL*
		BRUSHING & WEEDING BASIC & INTENSIVE - CROWN LAND ONLY (Hectares)				
CARIBOO	N/A	20	0	0	0	0
KAMLOOPS	N/A	265	0	3	0	300
NELSON	N/A	0	6	290	683	1000
PG	N/A	57	0	0	156	200
PR	N/A	93	297	121	671	1200
VANCOUVER	N/A	2500	3057	4009	5544	15100
TOTAL*	0	2900	3400	4400	7100	17800

*Rounded

Figure C-10 shows the total Crown land surveyed and Figures C-11 and C-12 show the percentage considered satisfactorily stocked.

In addition to regeneration surveys, the ministry has established a monitoring system to assess the survival and growth performance of ministry and licensee plantations. A survival survey is conducted one to three years after planting to assess the survival of planted stock. If the number of surviving, well-spaced, planted trees is below the minimum required for acceptable stocking, a regeneration or stocking survey is conducted. Acceptable stocking levels, either of planted stock or a combination of planted and natural trees, results in the area being reclassified from NSR to SR.

The seedling survival rates in Table C-2 are based on plantations established between 1970 and 1980. These are averages only; the survival on individual sites may vary considerably from the mean.

An area classified as SR following a survival survey can be reclassified as NSR later if the trees suffer from suppression or death. The major cause of plantation mortality is drought, followed by brush competition and animal browsing. Other factors such as species, stock type and stock handling also play a role although they are somewhat more difficult to identify.

Table C-2. Seedling Survival Rates in Plantations

A. Coast

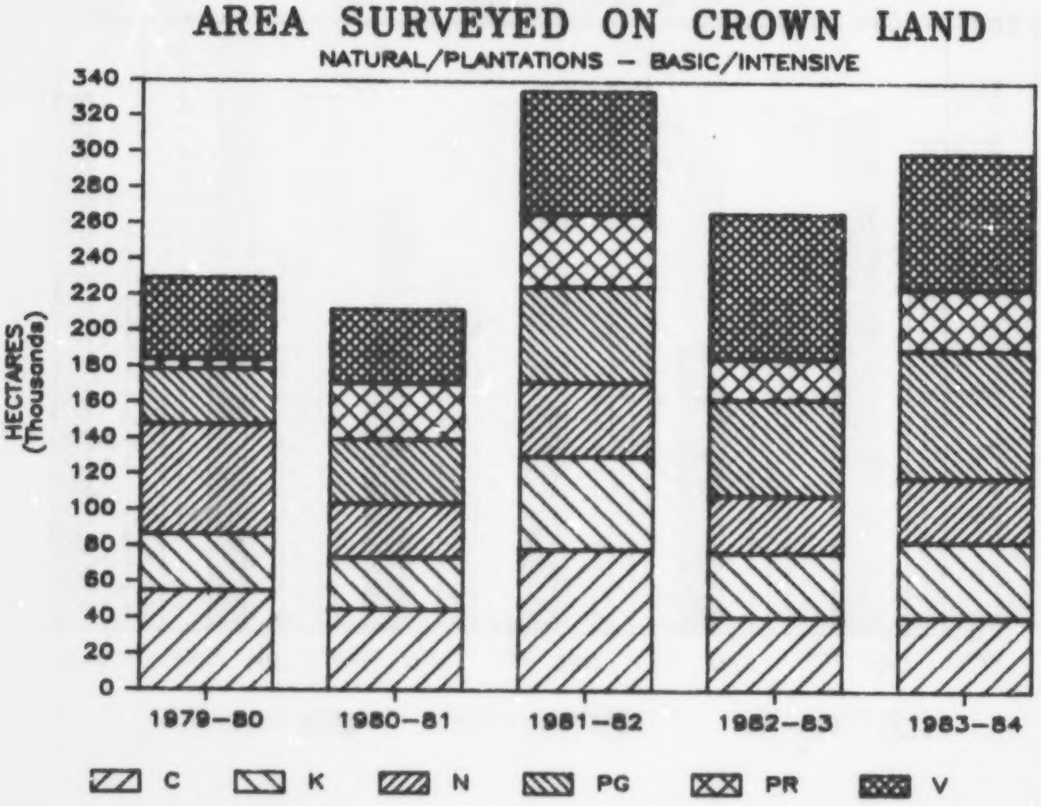
Species	Survival Rate (%)
Douglas-fir	60 to 70
Hemlock	60 to 70
Sitka spruce	80+

B. Interior

Species	Survival Rate (%)
Engelmann spruce	70 to 80
Lodgepole pine	70 to 80

In addition to survival and free-growing surveys, plantations are assessed for growth performance and compared to a standard height-age curve showing expected performance for the applicable ecological subzone. This procedure is termed regeneration performance assessment. This program is relatively recent, and data is still being collected and collated into a useable format.

Figure C-10

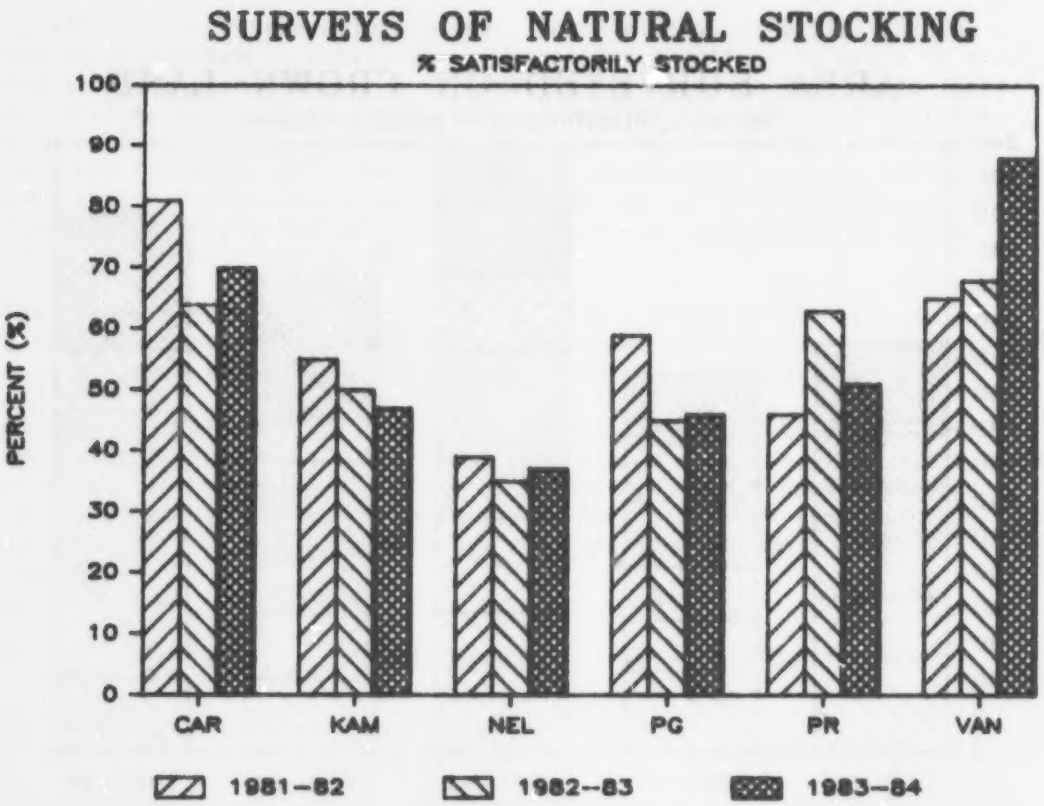


SURVEYS OF NATURAL RESTOCKING & PLANTATIONS - AREA SURVEYED
BASIC & INTENSIVE - CROWN LAND ONLY

REGION	1979-80	1980-81	1981-82	1982-83	1983-84	TOTAL*
			(Hectares)			
CARIBOO	55204	44943	78750	41227	41484	261600
KAMLOOPS	31497	28842	51715	35952	42105	190100
NELSON	61202	30265	41433	31802	35529	200200
PG	30872	35678	53375	53941	71460	245300
PR	5311	31457	40708	22770	34212	134500
VANCOUVER	45623	41345	68603	81131	75677	312400
TOTAL*	229700	212500	334600	266800	300500	1344100

*Rounded

Figure C-11



SURVEYS OF NATURAL RESTOCKING ON CROWN LAND- % SATISFACTORILY STOCKED

CURRENT & BACKLOG

REGION	1981-82	1982-83	1983-84
		(%)	
CARIBOO	81	64	70
KAMLOOPS	55	50	47
NELSON	39	35	37
PG	59	45	46
PR	46	63	51
VANCOUVER	65	68	88
WEIGHTED AVERAGE	61	55	59

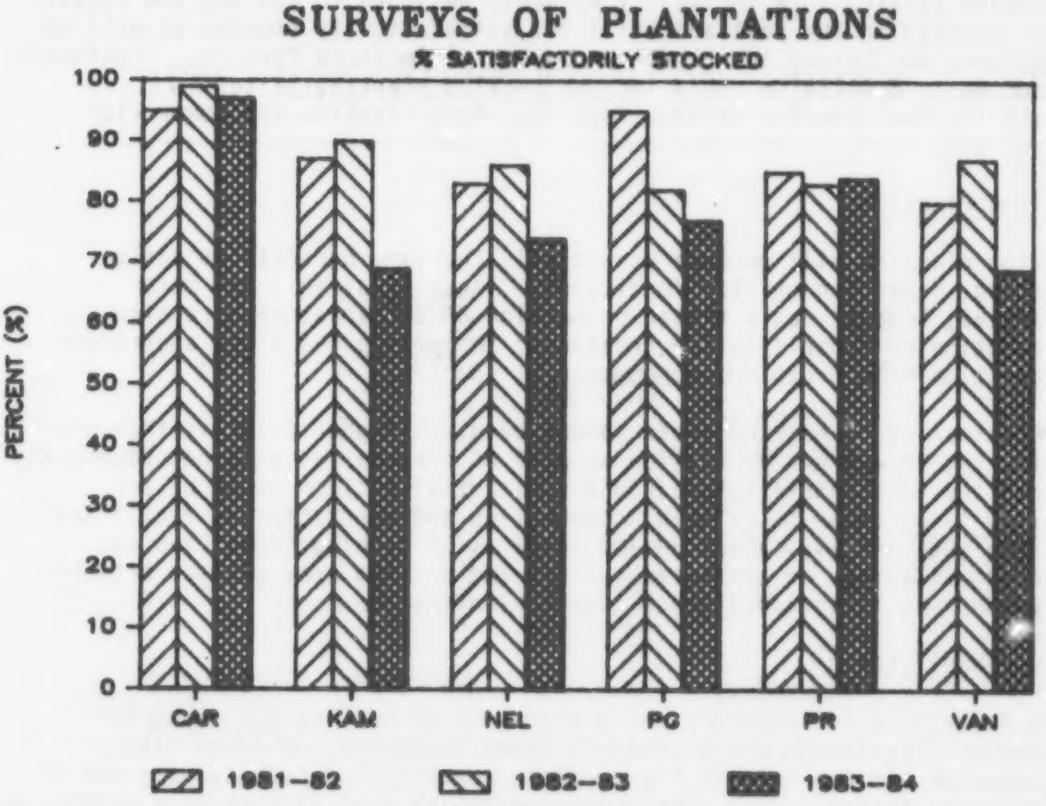
SURVEYS OF NATURAL RESTOCKING ON CROWN LAND- AREA SURVEYED

CURRENT & BACKLOG

REGION	1981-82	1982-83	1983-84	TOTAL*
		Hectares		
CARIBOO	68616	18955	27391	115000
KAMLOOPS	40345	27019	26253	93600
NELSON	31361	23308	28761	83400
PG	35685	37123	35054	107900
PR	34065	14104	22819	71000
VANCOUVER	26043	49454	41360	116900
TOTAL*	236100	170000	181600	587700

*Rounded

Figure C-12



SURVEYS OF PLANTATIONS ON CROWN LAND- % SATISFACTORILY STOCKED
CURRENT & BACKLOG

REGION	1981-82	1982-83	1983-84
		(%)	
CARIBOO	95	99	97
KAMLOOPS	87	90	69
NELSON	83	86	74
PG	95	82	77
PR	85	83	84
VANCOUVER	80	87	69
WEIGHTED AVERAGE	85	87	77

SURVEYS OF PLANTATIONS ON CROWN LAND- AREA SURVEYED
CURRENT & BACKLOG

REGION	1981-82	1982-83	1983-84	TOTAL*
		Hectares		
CARIBOO	10134	22272	14093	46500
KAMLOOPS	11370	8933	15852	36200
NELSON	10072	8494	6768	25300
PG	17690	16818	36406	70900
PR	6643	8666	11393	26700
VANCOUVER	42560	31677	34317	108600
TOTAL*	98500	96900	118800	314200

***Rounded**

INTENSIVE SILVICULTURE

Intensive silviculture includes treatments designed to restock the forest lands denuded in the past and still not satisfactorily stocked as well as treatments to improve the growth and value of immature forests. Treatments conducted in British Columbia include backlog planting, site rehabilitation, conifer release, spacing, fertilization and commercial thinning.

Backlog Planting

Backlog planting will produce essentially the same benefits as basic planting, depending on site conditions. These treatments are more expensive, however, as a higher proportion of the areas require site preparation or rehabilitation treatments to open up the sites and reduce competition from brush and noncommercial species.

The restocking of backlog areas should be given higher priority than the restocking of current denudation as most of these sites will not regenerate within the foreseeable future and a substantial portion is on better quality lands close to existing communities and manufacturing facilities. Between 1981 and 1984 about 30,300 hectares of backlog Crown land was planted. A survey of the total current and backlog area planted between 1979 and 1984 is included under 'Basic Planting'.

Site Rehabilitation

Site Rehabilitation involves the preparation of backlog NSR areas for planting. Treatments are similar to those conducted for basic site preparation but can involve the complete removal of decadent, stagnant or undesirable forest cover. These treatments are usually much more expensive than standard site preparation activities because of the cost of clearing the brush and deciduous vegetation, which often invades a site when restocking is delayed. Site rehabilitation was conducted on 12,100 hectares between 1979 and 1984 (see Figure C-13 for details).

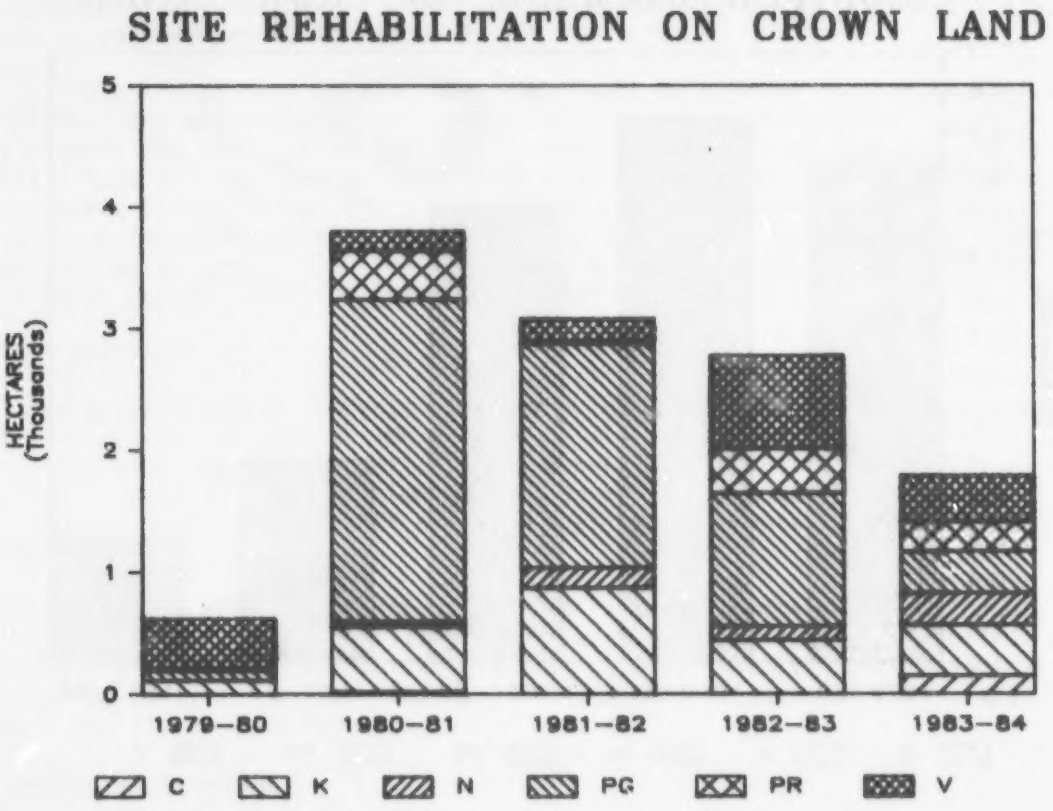
Conifer Release

Conifer release involves eliminating undesirable competing trees (usually deciduous) where an understory stand of commercial species is being suppressed. Treatments involve cutting by hand or power tools, broadcast application of herbicides (by helicopter or backpack) or the direct application of herbicides to individual trees (hack and squirt). Herbicides prevent the vigorous sprouting associated with mechanical clearing methods. Treatments were conducted on 9,000 hectares between 1979 and 1984 (see Figure C-14 for details).

Spacing

Spacing can be conducted wherever dense, immature forests exist and involves the removal of selected trees to reduce density. This reduces competition for crown and root space within the stand. Growth normally lost to natural mortality of crowded trees is thus concentrated on the remaining crop trees.

Figure C-13

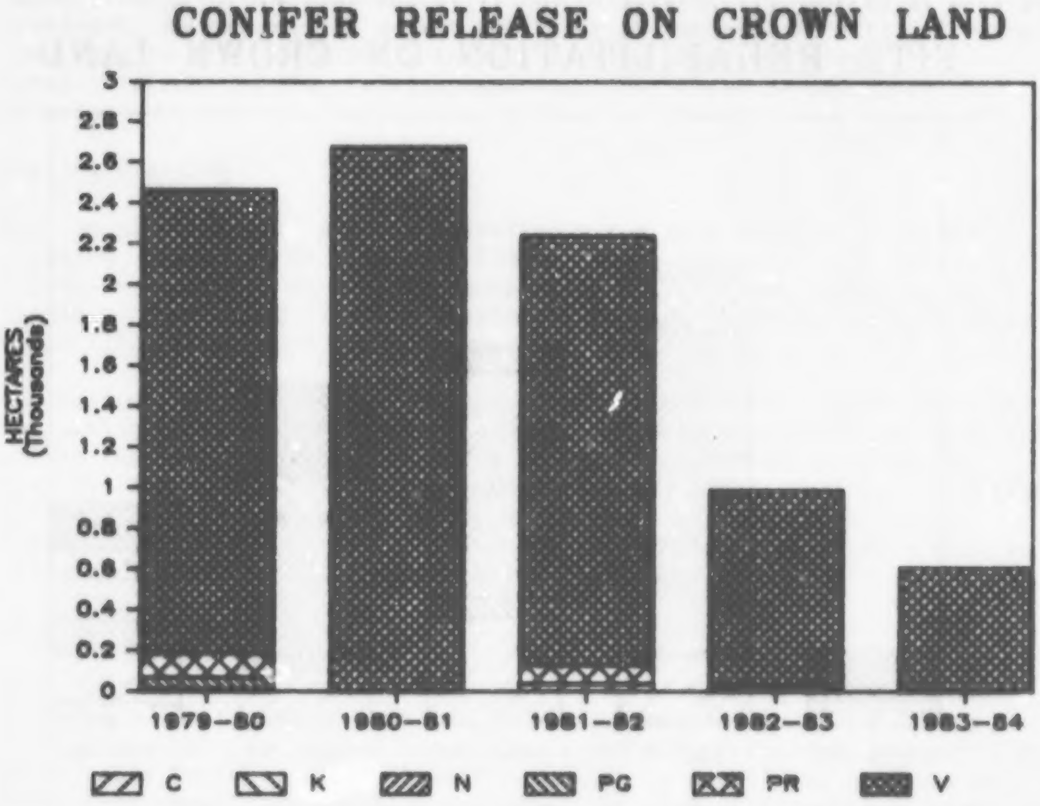


SITE REHABILITATION
CROWN LAND ONLY

REGION	1979-80	1980-81	1981-82	1982-83	1983-84	TOTAL*
			(Hectares)			
CARIBOO	0	20	0	0	151	200
KAMLOOPS	114	535	875	445	415	2400
NELSON	0	45	162	113	260	600
PG	81	2643	1841	1092	344	6000
PR	14	403	20	366	241	1000
VANCOUVER	415	159	189	766	381	1900
TOTAL*	600	3800	3100	2800	1800	12100

*Rounded

Figure C-14



CONIFER RELEASE
CROWN LAND ONLY
(Hectares)

REGION	1979-80	1980-81	1981-82	1982-83	1983-84	TOTAL*
CARIBOO	0	0	39	0	0	0
KAMLOOPS	12	0	0	8	0	0
NELSON	0	0	0	0	6	0
PG	57	0	0	0	0	100
PR	118	0	91	21	0	200
VANCOUVER	2280	2680	2116	963	603	8600
TOTAL*	2500	2700	2200	1000	600	9000

*Rounded

While the useable volume of spaced forests is expected to be similar to that of unspaced forests at the time of harvest, this volume is concentrated in far fewer trees. The benefits of harvesting fewer but larger trees include reduced logging costs, reduced sawmilling costs, increased lumber recovery, production of higher-value forest products and increased revenues to the Crown.

Logging costs go down because fewer logs must be handled to produce a given volume. The magnitude of the reduction will depend on terrain, logging equipment and the size of the trees. Sawmilling costs go down because fewer logs must be handled to produce a given volume of lumber and because the trees have a more uniform size, which reduces sorting costs. Lumber recovery increases because logs with larger diameters can produce a higher percentage of lumber than smaller logs. Spacing was conducted on 78,800 hectares between 1979 and 1984 as detailed in Figure C-15.

Fertilization

To date, only coastal forests composed primarily of Douglas-fir have been fertilized operationally. More research will be needed to determine whether other species and sites would benefit sufficiently to justify an enlarged program. Application by helicopter is the most common method although fixed wing aircraft and hand-operated spreaders have also been used.

Fertilized forests grow faster than unfertilized forests for a period of six to ten years after fertilizer application. Fertilization of spaced forests will result in a better overall response than fertilization of unspaced forests. Between 1979 and 1984, 36,000 hectares of Crown lands were fertilized (see Figure C-16 for details).

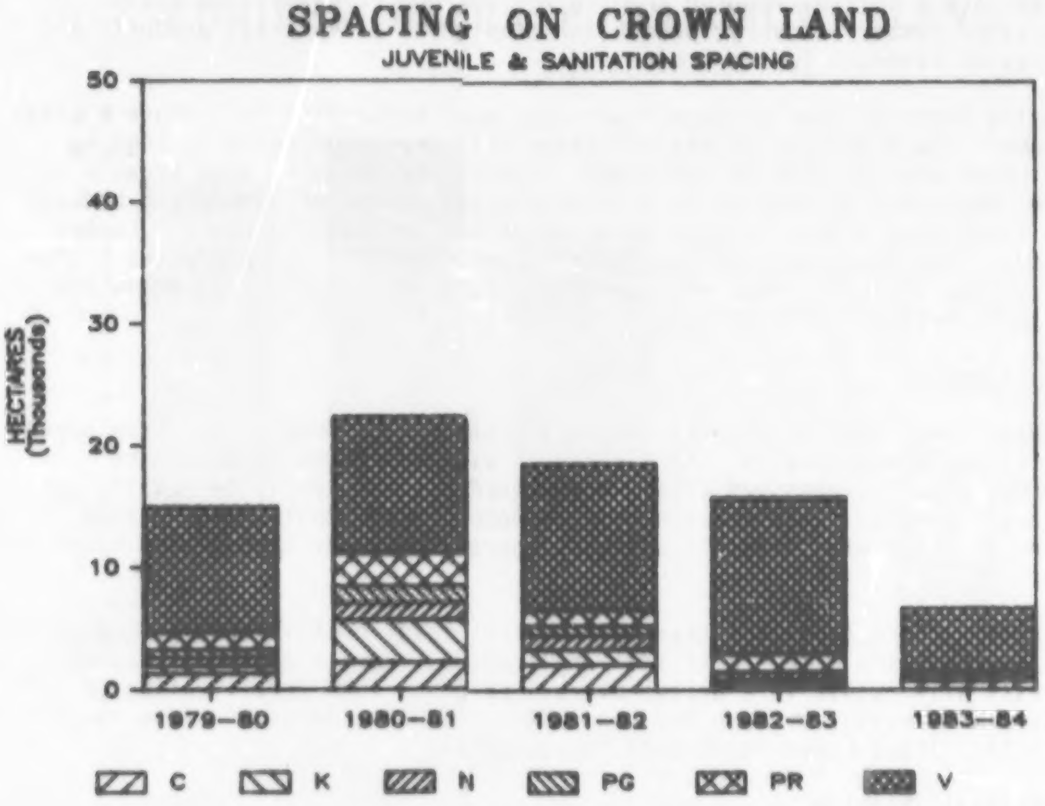
Commercial Thinning

Commercial thinning provides many of the same benefits as spacing. This treatment is usually applied in older immature forests. However, when log sizes are larger the treatment costs may be partially or fully recovered through sale of the extracted material. Forest product markets must be particularly buoyant to ensure the viability of this type of operation since the logs are still small and the extraction costs high. Commercial thinning was conducted on 130 hectares between 1979 and 1984. Figure C-17 provides more details.

Other Intensive Management Treatments

Other intensive management treatments include mistletoe control, pruning and seedtree control, as well as any other activities which do not fall within a more specific category. These other treatments were conducted on 8,700 hectares between 1979 and 1984 as illustrated in Figure C-18.

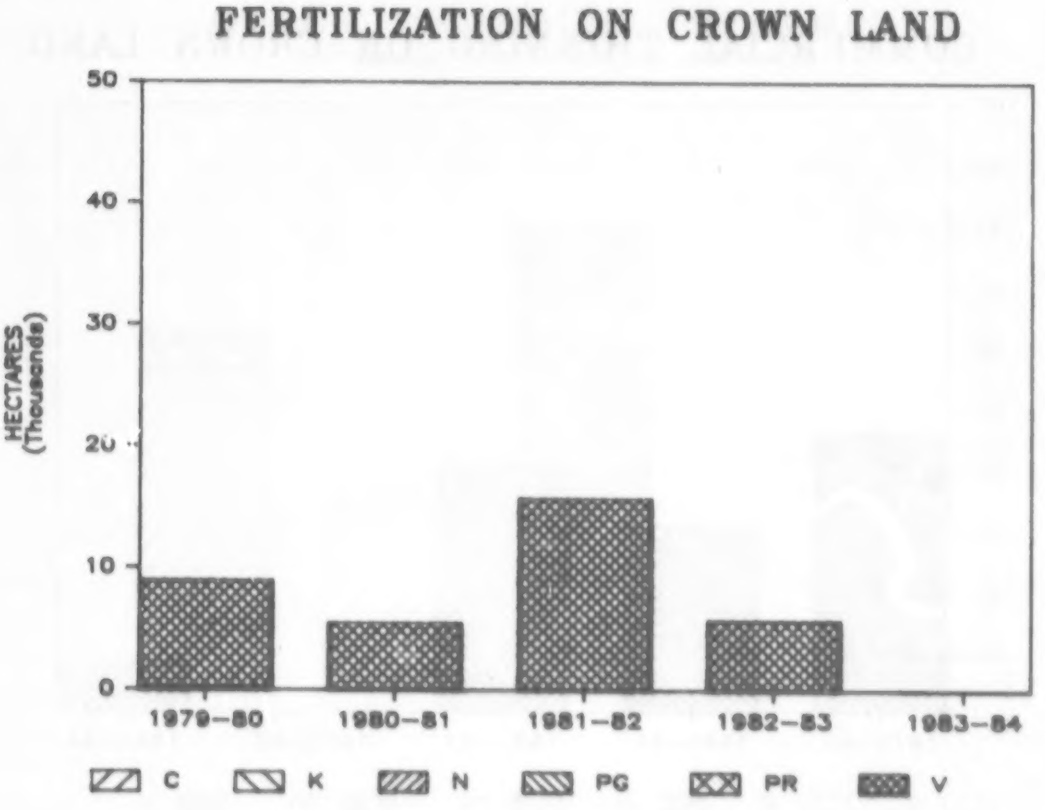
Figure C-15



REGION	1979-80	1980-81	SPACING* CROWN LAND ONLY 1981-82 (Hectares)	1982-83	1983-84	TOTAL**
CARIBOO	1343	2243	2109	531	801	7000
KAMLOOPS	629	3487	1269	311	36	5700
NELSON	690	1406	1157	635	444	4300
PG	657	1352	795	0	36	2800
PR	1458	2751	1323	1526	236	7300
VANCOUVER	10279	11185	12017	12846	5200	51500
TOTAL**	15100	22400	18700	15800	6800	78800

* Includes juvenile spacing and sanitation spacing
**Rounded

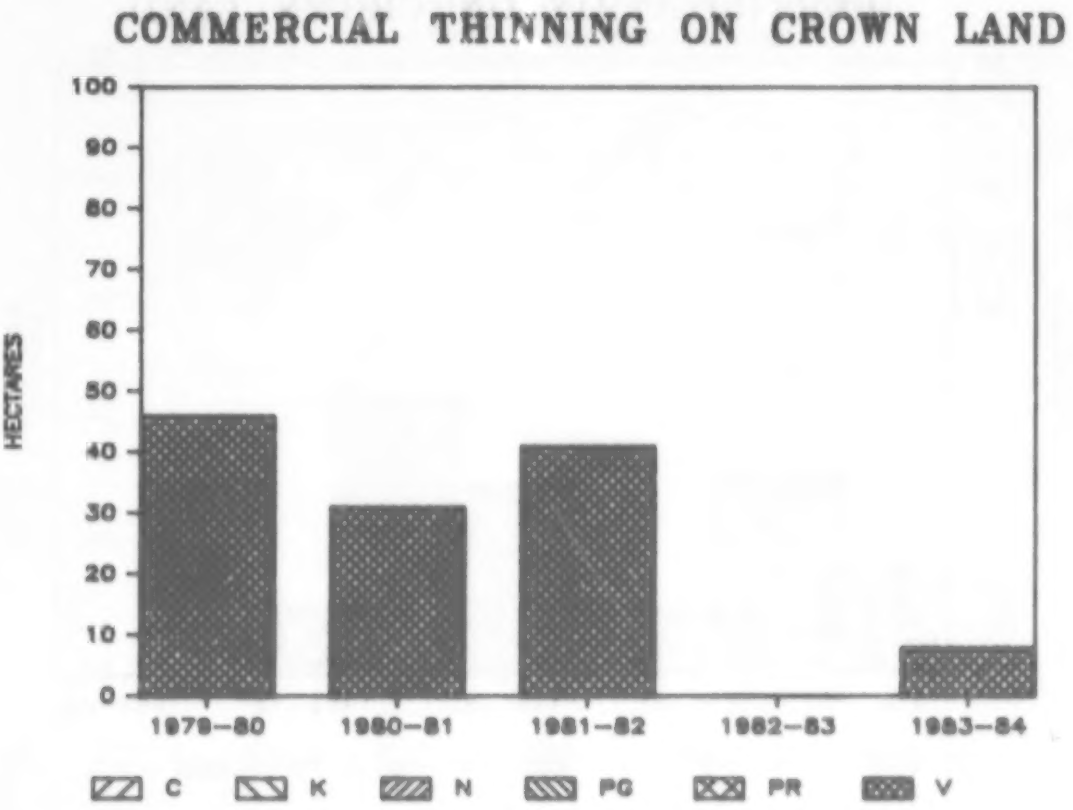
Figure C-16



			FERTILIZATION CROWN LAND ONLY			
REGION	1979-80	1980-81	1981-82 (Hectares)	1982-83	1983-84	TOTAL*
CARIBOO	0	0	0	0	0	0
KAMLOOPS	23	11	0	0	0	0
NELSON	0	0	0	0	0	0
PG	0	0	0	0	0	0
PR	164	0	0	0	0	200
VANCOUVER	8830	5505	15746	5759	0	35800
TOTAL*	9000	5500	15700	5800	0	36000

*Rounded

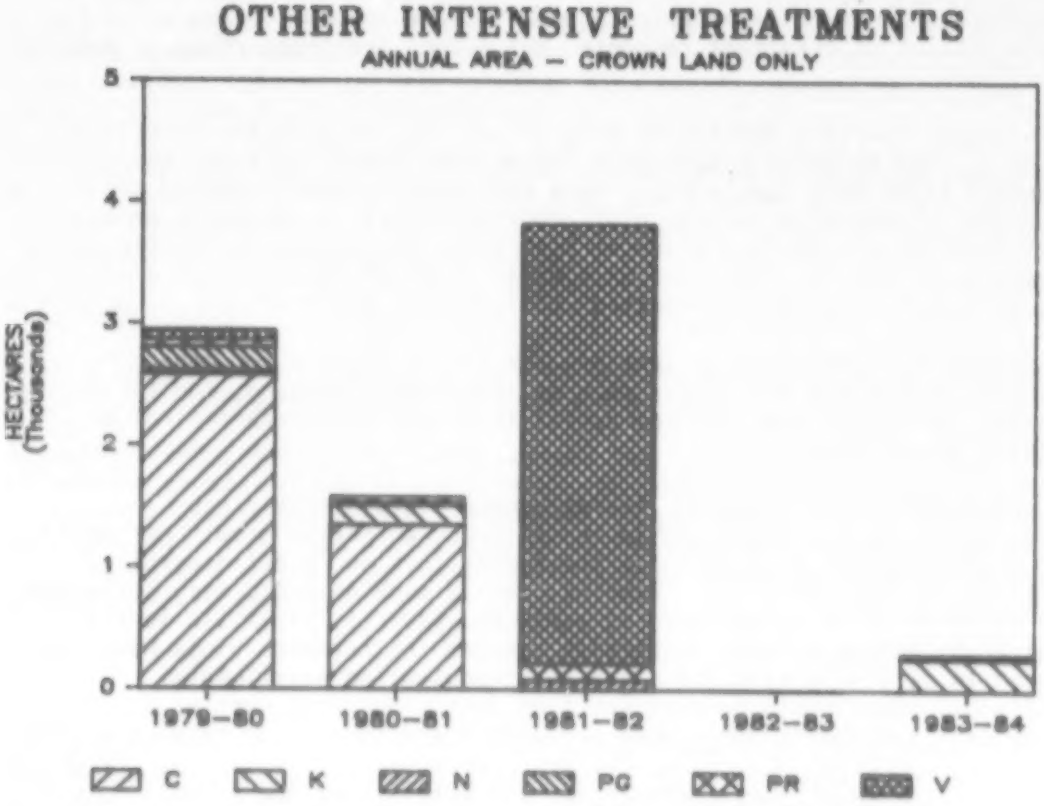
Figure C-17



REGION	1979-80	1980-81	COMMERCIAL THINNING CROWN LAND ONLY 1981-82 (Hectares)	1982-83	1983-84	TOTAL*
CARIBOO	0	0	0	0	0	0
KAMLOOPS	0	0	0	0	0	0
NELSON	0	0	0	0	0	0
PG	0	0	0	0	0	0
PR	0	0	0	0	0	0
VANCOUVER	46	31	41	0	8	130
TOTAL*	50	30	40	0	10	130

*Rounded

Figure C-18



OTHER INTENSIVE MANAGEMENT TREATMENTS*
CROWN LAND ONLY

REGION	1979-80	1980-81	1981-82 (Hectares)	1982-83	1983-84	TOTAL**
CARIBOO	2586	1350	0	0	0	3900
KAMLOOPS	0	167	0	0	263	400
NELSON	27	0	80	0	5	100
PG	192	11	0	0	0	200
PR	63	54	136	0	0	300
VANCOUVER	83	0	3614	0	30	3700
TOTAL**	3000	1600	3800	0	300	8700

* Includes mistletoe control, pruning and seed tree control
**Rounded

YIELDS FROM INTENSIVE FOREST MANAGEMENT

Although treatment cost information can be estimated by extrapolating from historical cost data, growth data for managed stands is harder to come by. Literature and practical experience provide some information on which to base estimates of treatment response, but actual treatment response data is unavailable.

An intensive forestry monitoring program was initiated by the Inventory Branch in 1979 to build a data base for managed stand yield tables. Permanent fixed area sample plots have been established in spaced and fertilized stands with control plots located in nearby untreated areas. Remeasurements are to take place at five-year intervals with the first remeasurement due in 1984. Response data is therefore unavailable until this information has been collected, collated and analyzed.

No operational monitoring systems are currently in place for other intensive management activities such as site rehabilitation, conifer release, sanitation spacing, commercial thinning, seed tree control or brushing and weeding.

The Research Branch maintains several growth and yield research installations on the coast and in the interior to obtain growth response data from intensive silvicultural treatments such as juvenile spacing, fertilization and commercial thinning. While much data has been collected from research plots established as early as 1929, it is limited in its application to operational treatments because the research plots have been located in carefully selected sites under controlled experimental conditions. What could be expected from less rigorously applied operational treatments under more variable stand conditions remains unclear.

Several of the major forest companies have established operational monitoring systems designed to generate yield estimates from intensive management treatments, notably juvenile spacing and fertilization. But most of these are either research-oriented systems and generate information that is too localized to be widely applicable or have been implemented relatively recently and have not yet generated data for general use.

The various licensee monitoring systems have not been fully evaluated for efficiency and reliability or compatability with Ministry of Forests' data.

PEST CONTROL PROGRAMS

Control treatments directed specifically against forest pests are aimed mainly at bark beetles although control of other forest pests may be the primary or secondary objective of intensive silvicultural treatments such as juvenile and sanitation spacing (bark beetles, mistletoe), site rehabilitation (mistletoe, root rot) and knocking down all residual stems 3 m or taller left after logging (mistletoe). Estimates of wood volume saved annually through the various control methods are not currently available.

Bark Beetle Control

The Canadian Forestry Service and the Ministry of Forests conduct annual aerial and ground surveys to detect bark beetle infestations and assess the extent of damage. Control methods include harvesting, felling and burning infested trees, chemical treatments and catching the beetles with trap trees. Target species include mountain pine beetle, spruce beetle and Douglas-fir beetle.

The stand's response is measured by the amount of re-infestation observed during subsequent surveys. Areas infested and treated and survey results are published annually in map form by the Canadian Forest Service and in the ministry's Annual Report.

Mistletoe Control

Mistletoe control measures usually involve eliminating infected residuals through harvesting or felling, bucking and burning.

In most forest regions, mistletoe control has been incorporated into other harvesting or silvicultural activities. No formal mistletoe control or treatment response monitoring program exists in the province. Logged or infested areas are inspected to determine the need for treatment but no assessments are made of the potential effect of mistletoe eradication on subsequent tree growth.

TRANSPORTATION SYSTEM

The transportation system is critical to the timber resource's industrial utility: without a road to reach the timber, it could not be developed; and without the linkages through the public transportation system, it could not reach mills and markets.

The Ministry of Forests and the forest industry have a large capital investment in the network of logging roads throughout the province. These roads are used primarily to transport timber to the various processing mills, but also by the public to reach recreation areas. Where travel on forest roads is hazardous, public travel is generally restricted to the times when logging trucks are not operating.

Roads are classified according to their purpose and permanency into two categories. Category 1 includes main haul roads used to transport logs from the harvesting area to rail head, highway log dump or processing plant. Category 2 roads are primarily branch roads off main haul roads, interconnecting links or roads built primarily for protection, silviculture or administration. They also include public access roads which are still under Forest Service jurisdiction. Category 2 roads are generally of a lower standard than Category 1 roads.

Bridges are also classified according to their permanency into three categories: permanent, semi-permanent and temporary. A permanent bridge has all its major components constructed of steel, concrete, glue laminated or pressure-treated timber. A semi-permanent bridge has a substantial portion of its components constructed of the same materials as in a permanent bridge. A temporary bridge has most of its components constructed of untreated wood.

Permanent bridges and multiplate culverts, because they are located on permanent roads and are a significant part of the capital cost of the road system, are included in the road inventory. Semi-permanent and temporary bridges and small culverts on forest roads also form a major part of road costs. The ministry is presently compiling a detailed inventory of all bridges and culverts and will include this in the next Resource Analysis.

Table C-3 shows for each region the kilometres covered by Category 1 and Category 2 roads, and the number of single span (S) and multi-span (M) permanent bridges and the number of multiplate culverts (M-P).

CONDITION OF THE TRANSPORTATION SYSTEM

An extensive review of the transportation system showed conditions to be much better than anticipated, but each region exhibits some problems that require remedy. Because of the potential implications that these could have on distribution of forest products and cost of transport, a synopsis is included here for each region.

Vancouver Region

On the coast, most logs are hauled on relatively short logging roads, dumped into the water and towed directly to the processing plant. Therefore, foreshore handling facilities are an important aspect of the industry. Information in the 1981 Estuary, Foreshore and Water Log Handling and Transportation Study indicates that log handling uses of the foreshore occupy almost 9,000 hectares of which 25% is primarily marine intertidal, 12% is estuarine and 13% is riverine. While these areas are relatively small compared to the total coastal area in each category, a high concentration of these leases occurs on southeastern Vancouver Island and in the Howe Sound/Fraser River area. Approximately 13% of the existing leases will be abandoned by the year 2,000 but as new logging areas are developed, 3,000 hectares of new foreshore leases will be needed. The resulting net increase is almost 2,000 hectares. The greatest expansion will likely occur on Vancouver Island's northwest coast and on the mainland's north coast. A net increase of almost 500 hectares is expected to occur in the south coast of the mainland and Vancouver Island where the conflicting pressures on the foreshore are most acute.

Water storage requires sheltered water to minimize buffeting and damage to booms, and long-term storage requires low salinity to minimize losses from wood-boring teredos and crustaceans. Most companies prefer deep, sheltered water as close as possible to converting plants. In many instances, though, shallow and medium-depth estuaries are the only areas that are sheltered, have low salinity and are adjacent to existing mills.

Land storage is not a practical solution for most mills located on the coast. Often sufficient land is unavailable adjacent to the mill and, when it is available, it is extremely expensive. Moreover, larger capital costs are associated with high-density log storage equipment and most mills are designed to receive logs from the water.

Table C-3. Inventory of Forest Service Roads and Bridges

		Category 1				Category 2		
Region	Unit	Roads km	Bridges S	Bridges M	M-P culverts	Roads km	Bridges	M-P culverts
Cariboo	TSA	1354	3	7	3	1685	7	2
	TFL	55						
Kamloops	TSA	2897	12	3	8	3143	2	
	TFL	261	5		1	194	7	
Nelson	TSA	3598	[illegible]	19	13	3169		4
	TFL	1110	55			1263	49	3
Prince George Northeast	TSA	282	3	3	3	104	1	3
Prince George	TSA	2534	53	6	16	1784	31	7
	TFL	95		2		100		2
Prince Rupert Interior	TSA	751	15	2	3	505	4	2
Prince Rupert Coast	TSA	293	13			67	4	
	TFL	726	124	12		1307		2
Vancouver	TSA	1330	34	9	2	1411	16	1
	TFL	3024	133	37	1	4927	109	5

S - single span bridge
M - multi-span bridge
M-P - multiplate culvert

In the past, foreshore leases have been retained only for the harvesting period. But foreshore areas may be required intermittently after initial logging is completed: intensive forest management activities such as commercial thinning may require log handling facilities; and the second and subsequent harvests will, in all probability, require some form of foreshore use. Therefore, the possibility of maintaining foreshore areas over a rotation period should be considered. These sites could be used for other purposes when not needed for log handling.

Harvest areas, which were initially close to the mills, now extend along the entire mainland coast and over most of Vancouver Island and numerous smaller islands. The supply areas are separated from milling centres by mountains, fjords and open water, all of which severely limit land transportation. Water transportation is therefore the vital link between harvesting areas and the consuming mills.

Logs are transferred from the land to water in various ways including lift-and-lower, marine rail, log skid and mobile loader systems. Of the total volume, at least 70% is now dumped in bundled form. Log dump sites reported in the survey occupy slightly over 200 hectares on the entire British Columbia coast, which represents about 2.3% of the total area of all log handling and storage lease areas. About 46% of the coastal log volume is currently dumped by some form of fully controlled system such as a lift-and-lower or marine rail system, and about 47% of the coastal log volume enters the water by some form of skid system although use of this latter system is declining. Helicopter dumping and other free fall systems account for the remaining 7%.

Three methods are used to move logs along the coast: flat rafts, bundle booms and log barges. Flat rafts or bundle booms are used to transport camp-run logs to sorting grounds and to take sorted logs to conversion plants. Bundle booms are generally used for tows of 40 km or longer, while flat rafts are used for shorter distances in sheltered waters. Bundle booms have become the dominant method of transport primarily for three reasons: tow volumes can be doubled; they prevent logs from escaping or sinking; and they require less storage area. Log barges, which require major capital investments, are usually used to haul large volumes from isolated camps through unprotected waters. Logs are usually loaded by on-board cranes, with logs either loose or bundled. Bundles are preferred to reduce loading time and to minimize log sinkage and breakage. Loading and unloading normally take place in sheltered waters near storage sites.

The water transportation of logs does not in itself create environmental problems, although log losses during transportation contribute to the debris problem. These losses are being reduced through increased use of bundled booms and barges. However, foreshore leases for storage and handling are usually located in the tidal reaches of rivers, estuaries, wetlands, intertidal zones and coastal zones, virtually all of which are highly productive environments. Thus, log handling must take environmental considerations into account both in design and operation. The coastal forest industry has developed and is implementing a number of procedures to reduce their operations' impact on the environment.

In addition to log handling uses, a wide range of other uses can affect the foreshore environment. Recreational and commercial uses, urban and industrial effluent, and foreshore development are just a few of the uses than can lead to degradation and reduce productivity. Thus, decisions regarding log handling facilities must recognize the entire system and its uses.

Logs hauled directly to the sawmills by truck on public roads account for only a small portion of the total volume of logs transported to the processing centres. But industrial traffic is expected to increase slightly on some public highways as a result of:

- the reduction in the number of access points to water
- the increase in Small Business Enterprise Program operators,
- the increase in logging of second growth timber on Vancouver Island's east coast and on the lower mainland. These stands are close to processing centres, and thus logs will likely be hauled on trucks directly to the plants.

The following routes will be most affected:

- No. 101, Sunshine Coast Highway between Madeira Park and Langdale;
- No. 19, Island Highway between Courtenay and Parksville;
- No. 4, along most of the route from Port Alberni to Ucluelet;
- No. 99, between Brohm Lake and Whistler.

To reduce dependence on highways would require higher standard forest roads, more local access to the foreshore, and special loading and unloading facilities on railroads.

Prince Rupert Coast Region

In the Prince Rupert Coast region, as in the Vancouver region, most of the logs are transported on short logging roads to tide water. Virtually all logs harvested on the Queen Charlotte Islands are transported by barge to the south coast for processing. The same is true on the north coast except for the area adjacent to Highway 16.

Almost all lumber products are transported on the CN north line either to the port of Prince Rupert for export offshore or south into the North American market. Chips are transported by truck and rail to pulp mills at Prince Rupert, Kitimat and Prince George.

Log and chip truck traffic is expected to increase on Highway 16 along the Skeena River from Terrace and Hazelton. Within Prince Rupert city, congestion will increase since traffic must pass through town to reach the port and ferry facilities. The proposed new sawmill at Prince Rupert could also result in increased truck traffic in the city if the road system is not improved: chips will have to be hauled from the sawmill to the pulp mill at Watson Island and lumber hauled through town to the port facilities.

Logging truck traffic through Terrace is also forecast to increase substantially. Up to 150 logging trucks, 50 chip vans and 50 lumber trucks are expected to move in and out of the Skeena sawmill daily. A similar number are expected to move in and out of the Pohle sawmill. Traffic on the Terrace to Kitimat highway will increase substantially as logs from Tree Farm Licence 41 are moved to Terrace and chips are moved from Terrace to Kitimat.

Prince Rupert Interior Region

Log transport in the Prince Rupert Interior region is primarily by truck on industrial and public road systems. Water transport is confined to the major lakes such as Ootsa and Babine which are used for bundle booming and log towing. Other lakes are used for log storage at the mill sites.

Since most logs are hauled on off-highway road systems, the pressure on the highway system is relatively light. However, logging trucks and summer tourist traffic are creating congestion in New Hazelton, South Hazelton, Smithers, Houston and Burns Lake on Highway 16. In addition, the Francois Lake and Babine Lake ferries are inadequate to handle the present logging traffic.

The industry is concerned about the possible deterioration in CN rail service to the forest industry as a result of the priority given to unit coal trains from the northeast coal development. If service does deteriorate, truck traffic on Highway 16 will increase.

Prince George and Prince George Northeast Regions

Generally, the public road system in the Prince George and Prince George Northeast regions is considered adequate to handle forestry traffic. As logging operations move to the northwest part of the timber supply area, either the B.C. Rail tracks north of Ft. St. James will have to be rebuilt or an alternate route will have to be developed.

The Forest Service has recommended an off-highway route around Ft. St. James, which would eliminate most of the logging traffic from the Sowchea Road and Highway 27. However, the route is costly and industry has shown no interest in developing the bypass around the town.

Logs are hauled into Prince George via Highways 16 and 97 and by rail. The ministry has received complaints about logging truck traffic coming off the Forest Service roads. The only alternative to using some of these roads is to use B.C. Rail. However, this is not considered a viable option because it would substantially increase transportation costs.

Virtually all lumber is loaded directly onto railcars for transportation to various markets. Lakeland Mills near Prince George is the only large mill not on rail and must haul its lumber to rail by trucks.

Within about 55 km of a pulp mill, chips are more economically transported by truck than by railcar. The large truck-trailer pup combinations now in use could pose traffic problems in congested areas near Prince George.

Cariboo Region

In the Cariboo region, the existing main haul road systems (including public roads and forest roads) can handle present and expected future harvests. However, haul costs could be reduced if off-highway loads were permitted on certain public roads. Specifically, hauls over the Nazko and Blackwater roads from Narcosli and south Kluskus supply blocks to Quesnel would be less expensive if off-highway trucks could be used.

Logging truck traffic from the timber stands west of Quesnel must cross the Fraser River over a bridge that leads close to the centre of town, and the loads are expected to increase from 156 to 208 loads per day.

Timber in the Anahim, Takla and Chilcotin supply blocks is too distant to be hauled to Williams Lake at the present haul cost rate. If off-highway trucks could be used on Highway 20, haul costs could be reduced and haul distances could be extended further west. A study should be done to determine feasibility of upgrading Highway 20 so that off-highway trucks could be used on it.

Transporting logs from the area enclosed within the two arms of Quesnel Lake is problematic. Unless towing of bundle booms is permitted on Quesnel Lake this area, known as the Junction Block, will be considered inaccessible due to high transportation costs.

Kamloops Region

For most of the Kamloops region, the public road system is adequate to accommodate the forest industry's transportation needs. Nonetheless, some problems are encountered on the following roads, primarily due to alignment, dustiness and extensive use by other traffic:

- the secondary public roads north of Lillooet to Goldbridge and the Cayoosh to Duffy Lake Road;
- Highway 40, from Lillooet to Goldbridge; the Gun Creek bridge has a height limit that restricts the size of load it can carry;
- the Cayoosh - Duffy Lake road, in addition to the above problems, has many one-lane bridges;
- the Okanagan Lake - Westside Road;
- Highway 24 west of Little Fort.

The large number of loads hauled through the center of Lillooet each day and the congestion caused by logging traffic in Kelowna and on the Okanagan Lake Bridge are other areas of concern. In addition, the bridges on Highway 8 from Merritt to Spences Bridge have 36 tonne load limits, which restrict the size of log loads.

The Highway 5 from Merritt to Kamloops carries a large number of chip truck loads but is capable of handling them even though the road is crooked because other traffic is fairly light. With the completion of the

Coquihalla Highway, other traffic will increase on this section of No. 5 and thus lengthen the travel time to Kamloops for industrial trucks.

Two lakes are used for water transportation: Adams and Shuswap. Public pressure to halt or reduce water transport on these lakes, if successful, will force companies to use the more costly road haul system. And since the public road from Squilax to Anglemount is inadequate to carry even the present public and industrial traffic, any additional traffic will require that it be improved.

The only major change in timber supply areas is the B.C. Forest Products Ltd. development in the Stein River drainage. A bridge across the Fraser River at Lytton is being considered to handle log hauls out of this area. This would increase logging truck traffic on Highway 1 from Lytton to Boston Bar.

Nelson Region

The transportation system in place is considered adequate to handle most of the traffic in the Nelson Region. Some opportunities exist to improve the system through additional off-highway haul roads. Overweight permits on short highway sections would help reduce haul costs in some areas.

Some of the main problem areas are as follows:

- logging development on the east side of the Kettle River will increase traffic on the Kettle River road, which will, therefore, interact with tourist traffic;
- in summer, heavy tourist traffic is causing congestion on Highway No. 3. As chips are forecast to be hauled by truck to the pulp mill at Castlegar from Midway and Grand Forks, summer traffic will become further congested;
- two companies haul logs from the northern part of the Arrow timber supply area to Lumby. Some of these trucks use both the Needles-Fauquier and Galena Bay-Shelter Bay ferries. In the summer months, tourists complain of delays due to logging trucks using up most of the space on the ferry;
- the mills at Wyndal, Erickson and Creston receive all their logs on highway trucks. The only problem areas are the Kootenay Lake Ferry crossing and along Highway 3A where logging truck traffic may cause congestion in the summer months during periods of heavy tourist traffic.

The major portion of the wood for the sawmill at Nelson comes from the Lardeau and Duncan River drainages. The logs are hauled on highway trucks to a dump near the north end of Kootenay Lake where they are watered and then towed to a sorting area near Harrop on the west arm of Kootenay Lake before going to the sawmill. Timber cut on the east side of Kootenay Lake is watered at Crawford Bay and also towed to the Harrop sorting ground.

Haul costs from the Lardeau and Duncan drainages could be lowered if off-highway loads were able to travel directly to the log dump on Kootenay Lake. This could be accomplished by allowing overweight trucks on the highway or by constructing a parallel haul road. Overweight permits on upgraded portions of the highway might be the least costly alternative, particularly since the public roads have low traffic volumes.

On-highway trucks must be used to carry wood from the southwest corner of the timber supply area on the west side of Lake Koocanusa since they cross Koocanusa bridge and a short section of Highway 3. Either overweight permits would be required for the Koocanusa bridge or a new structure would need to be built.

Logs must be hauled through the Kootenay National Park to the mill at Radium Hot Springs. The number of trucks and time of haul is restricted, particularly in the summer months. The alternative is to haul south to Canal Flats then north along Highway 93/95. Because this route is longer, it adds considerably to the haul costs.

With the creation of the Valhalla Provincial Park and no planned road access, the Forest Service will be pressured to maintain, upgrade or extend the present road system near the park boundaries.

CHAPTER C2

CONDITION OF THE RANGE RESOURCE

This chapter identifies some of the major factors that affect the condition of the range resources or the use that can be made of them. Current management strategies are outlined and, where management strategies are absent or incomplete, recommendations are presented.

FOREST ENCROACHMENT

About 69% of the forage used by livestock is from forested and transitional forest Crown lands. These areas and some open grasslands are subject to forest encroachment, a natural process during which near ground herbs and shrubs decline in composition and production, resulting in significant reductions in available forage for livestock and wildlife.

Three primary types of forest encroachment affect range management. The first occurs in commercial timber stands where forest succession proceeds rapidly from early post-harvest conditions, in which native forage is generally abundant, to immature and mature forested conditions in which forage availability is significantly reduced.

The second occurs in noncommercial deciduous stands and shrublands. In these areas, early successional stages are characterized by an abundance of forage dominated by grasses and forbs. But, as in-growth proceeds, forage production declines and less palatable shrubs dominate. In the final stages, the area is taken over by dense thickets of mixed coniferous-deciduous trees where little forage exists. This phenomenon is common in the Prince George and Peace River regions where the containment of wildfires has resulted in increased forest encroachment.

The third type of encroachment involves the extension of forest vegetation into lower, middle and upper grasslands. Thus areas of native grassland already reduced in size by other forms of land alienation, are further reduced by tree encroachment. This invasion is caused by the suppression of wildfires, and has resulted in greater pressure on the small areas of remaining grasslands to provide critical spring and fall forage for livestock and winter habitat for wildlife.

More than any other single factor, forest encroachment and its negative impact on forage production requires considerable attention if levels of forage production needed to meet existing and future livestock demands are to be achieved.

Presently, three management prescriptions are used to offset the reduction in forage production caused by forest encroachment. These include prescribed burning, grass seeding of cutblocks and selective thinning of stagnant forest stands.

In recent years, the use of prescribed burning to control forest in-growth has proven to be an invaluable management tool. This is particularly true in the Peace River area where prescribed burning in transitional stands of deciduous trees has led to significant improvement in wildlife habitat, brush control and forage production. Range burning has also been used successfully in other areas of the province where dry understory vegetation provides sufficient fuel to burn brushy or otherwise stagnant forested stands.

Field observations suggest that prescribed burning offers the most cost-effective management prescription for offsetting forest in-growth at about $6 to $12 per hectare. However, data to substantiate this claim is unavailable.

Stand thinning has also been used to control forest in-growth, particularly in stagnant stands of lodgepole pine, yellow pine and Douglas-fir growing on poor sites. While this prescription is effective in enhancing levels of forage production within these stands, the costs of stand thinning, piling and slash burning are prohibitively high, ranging from $375 to $450 per hectare.

Seeding of cutblocks with highly nutritious domestic forage is another method used to offset forest encroachment. On a comparative basis, grass seeding is relatively inexpensive, costing approximately $4 to $6 per hectare for aerial seed application and $70 to $85 per hectare for required site scarification. And when properly coordinated and integrated with silviculture prescriptions, it substantially increases the benefits derived from the forest land base since cattle can graze there without conflicting with forest regeneration efforts. Currently, 10% of the forest lands logged annually are seeded to produce forage.

To achieve optimum, cost-effective integration of range and forest management activities on cutblocks, appropriate sites must be selected and appropriate forest and range management prescriptions defined. This requires that a work group be established that will do the following:

1. develop operational trials to evaluate the biological and economic effects of various combinations of site preparation, silvicultural treatments, grass seeding and cattle grazing prescriptions on cutblocks;

2. coordinate and provide direction for developing silvicultural and range management prescriptions; and

3. assist in developing and implementing forest and grazing research projects directed toward producing the information needed to improve the integration of forest and range management activities on cutblocks.

In addition to these undertakings relevant to seeding cutblocks, information regarding all three management prescriptions needs to be synthesized and made available to field managers.

Furthermore, a range monitoring system needs to be established and economic analyses undertaken to determine the most cost-effective strategies for managing forest encroachment.

WEED ENCROACHMENT

Noxious weeds are a major threat to the condition of the Crown forage base, the most notable being spotted (Centaurea maculosa) and diffuse (C. diffusa) knapweed. These unpalatable weeds compete successfully with native perennial range vegetation. In fact, wherever these weeds become established, desirable range plants are virtually eliminated.

First introduced into North America from Eurasia in 1900, knapweed rapidly extended its range into British Columbia (1930). Scientists largely attribute this success to its being drought and cold tolerant, a rapid producer of highly viable seed and free of natural disease and parasitic organisms.

Knapweed infestation has grown rapidly from a few isolated locations in 1930 to 8,000 hectares (ha) in 1954, to 30,000 ha in 1972, and, according to current estimates, 84,000 to 95,000 ha in 1984. At this rate, knapweed infestation could reach 300,000 ha by the year 2000. This represents approximately one-quarter of all provincial native grasslands.

In an effort to retard the knapweed expansion, several provincial agencies and private interest groups began a chemical containment program in 1969. The principal objective of this program has been to contain the rate of spread by spraying areas where new infestations are reported. The 84,000 to 95,000 ha of heavily infested pastures are considered unsalvable. In such areas, losses in forage production are frequently up to 95% of potential.

The short-term benefits of the chemical containment program began to be realized in the late 1970's and early 1980's during which time annual funding grew gradually to $1 million (1982). At this level, the spread of knapweed into new areas of the Cariboo, Kamloops and Nelson Forest Regions was substantially curtailed. However, in the Boundary and Okanagan areas, where no containment program was initiated, knapweed infestations continued to increase dramatically both in number of sites and in density.

Recent cutbacks in funding will reduce the program's success and may lead to increases in knapweed infestations in the near future.

The most promising long-term solution to the knapweed problem is biological control. Numerous cooperative research activities in this area have been initiated in recent years. Their objective is to identify parasitic and predatory organisms that weaken the competitive advantage of knapweed over native range plants. Presently, six organisms including weevils such as Cleonus piger, root boring moths (Pterolonche inspera) and knapweed rust (Puccinia spp.) have been introduced into knapweed areas at various locations throughout the province. However, incomplete distribution, poor survival and insufficient impact have limited their effectiveness.

Substantial increases in research efforts, manpower and funding in the area of biological control will be required in the near future if positive results are to be expected within the time framework required to prevent knapweed from devastating provincial rangelands.

Concern over the knapweed problem coupled with the need to evaluate the effectiveness of the chemical containment program has led to the recent establishment of a computer file system designed to store information pertaining to site-specific containment activities. This represents a significant first step in developing a monitoring program that will document existing areas of knapweed infestation, new areas of infestation, rates of expansion and other information vital to the fight against knapweed.

Currently, only the areas covered under the containment program are monitored. If knapweed is to be contained successfully, the monitoring program must be extended to include areas where containment is not presently practiced and where biological agents have been released. The monitoring procedures also need to be refined to ensure that the parameters critical to knapweed's cost-effective management are being adequately assessed.

LIVESTOCK-WILDLIFE FORAGE COMPETITION

Continued alienation of lands capable of providing forage for livestock and wildlife has led to significant competition between domestic stock and wildlife for available forage. Most notable is the competition in the southern Trench area of the Nelson Forest Region, where elk numbers have increased dramatically from an estimated 8,000 animals in 1975 to as many as 18,000 - 20,000 today. This dramatic increase, combined with the livestock forage demand and diet similarities, has created significant pressures on the forage base. This problem has been exacerbated by forest encroachment, which has forced elk to concentrate on lower ranges traditionally used as spring and fall range for livestock.

If increases in elk populations continue unchecked, considerable damage to the Crown forage base is inevitable, and will result in undesirable socio-economic conditions for many residents of the southern Trench.

In other areas, competition between wildlife populations and livestock is not as significant. However, such actions as the recent introduction of elk into the west central Cariboo underline the need for a comprehensive strategy for forage allocation to livestock and wildlife. This would help resolve current livestock-wildlife conflicts and prevent their recurrence in the future.

The Ministry of Forests, in cooperation with the Ministry of Environment Wildlife Branch and other appropriate government agencies, should establish a small working group to address the issue of livestock-wildlife forage allocation. This work group should endeavour to do the following:

- identify critical components of the livestock-wildlife forage competition issue;
- identify principle geographic areas where livestock-wildlife competition has reached, or is approaching, resource conflict level;
- suggest steps that could be undertaken in the short term to achieve some degree of problem resolution; and
- make recommendations regarding long-term activities (e.g. research, simulation modelling) needed to ensure that the issue of livestock-wildlife forage competition is satisfactorily resolved.

LIVESTOCK PREDATION

Livestock predator problems are inevitable wherever wildlife and livestock occur in common and most noticeably in range units that adjoin remote, unsettled or sparsely settled areas.

Livestock predation losses result from deaths and from weight loss and reduced weight gain rates due to stress induced by predator activities but such losses have not been monitored so their extent and severity remains uncertain. Some suspect that indirect losses might substantially outweigh losses due to death. Livestock-predator problems appear to occur in cycles, peaking when wild ungulate numbers are reduced and predator numbers are relatively high. Data to substantiate this observation are unavailable.

Four options exist to resolve livestock predator problems:

1) ranchers can continue to suffer economically from livestock losses due to predation;
2) ranchers can be compensated for their losses;
3) more community pastures, which afford greater protection against livestock predation, can be developed in remote areas;
4) ranchers can be encouraged to develop private lands to provide spring, summer and fall ranges.

Because livestock losses from any source contain the efficient use of forage on Crown lands, the Ministry of Forests should determine the nature, extent and impact of the livestock predation problem and evaluate treatments that could be used to reduce those impacts. The options presented here should be seriously considered as possible strategies.

LIVESTOCK DISTRIBUTION

Livestock distribution depends on a number of natural and artificial structural features and various behavioural characteristics.

Cattle tend to congregate in traditional grazing areas to which they have been repeatedly exposed, and in areas where highly preferred forages dominate the vegetation. They also tend to move along traditional corridors and along routes that provide easy forage access.

Structural features also affect distribution. Where forested stands are heavily brushed in, cattle tend to select more open areas even if they contain less forage. Livestock also tend to favour flatlands and areas of shallow slope. They are also attracted to areas where management prescriptions such as burning, fertilization and grass seeding have enhanced the forage nutrient status and production.

Successful grazing management requires that these and many other factors that influence cattle distribution be understood and that proper corrective measures be taken. The placement of salt blocks and water away from areas where cattle congregate, combined with strategically located fences and the use of appropriately designed grazing systems help to distribute livestock and thus prevent damage to the forage base.

While livestock management is generally assumed to be adequate, problems do exist. These are particularly evident in some forested areas where grazing occurs in common with harvesting and forest regeneration activities. However, at present, neither the extent of the problem nor the potential trade-offs associated with resolving these problems are known.

To acquire this information and to resolve livestock distribution problems, the following should be done:

1) a range unit planning process should be implemented to aid in evaluating existing grazing management plans and the cost-effectiveness of capital improvements and other activities directed at cattle distribution.

2) a standardized cost-effective means of assessing forage utilization should be developed along with a way of monitoring grazing management practices.

3) an extension and staff training program should be implemented to provide education in grazing management, inventory and monitoring, animal nutrition and other appropriate disciplines.

4) only qualified agrologists or other related professionals should be hired to fill vacant range management positions.

5) a range inventory should be developed that characterizes the extent and condition of the range resource at the range unit level of management.

6) where livestock distribution problems exist, the necessary corrective measures afforded under present legislation should be taken.

SETTLEMENT AND OTHER LAND USES

Expanding urban areas are responsible for alienating some of the most valuable spring and fall Crown ranges, since both towns and ranges tend to be located in river valleys. In addition to the land alienation, pets, other livestock and vehicles, all of which are associated with settlement, disturb grazing livestock. Finally, urban settlement sometimes blocks water supplies and cattle trails. Expanding agricultural uses are also responsible for alienating valuable spring and fall ranges.

OTHER LIMITING FACTORS

Several factors restrict livestock from harvesting available forage. These are:

1) topography
2) unsuitable habitat
3) access limitation
4) water limitation
5) boundary control
6) water control, and
7) soil moisture and nutrients.

Topography can restrict livestock from reaching some forage on benches and other inaccessible areas. However, many of these areas may be suitable for wildlife.

Unsuitable habitat refers to forested range that has adequate forage but where livestock distribution is difficult to achieve because of predators, distance from the ranch base and other factors. The problem can sometimes be treated by clearing.

Access limitations may be overcome with trail developments; water limitations with water developments, and boundary control with fencing developments. A large portion of ARDSA expenditures and Ministry of Forests expenditures have been directed toward these problems.

Water control in some wetland sites is a continuing problem. Some drainage and irrigation projects have been undertaken in cooperation with Ducks Unlimited, individual ranchers and other government ministries.

Soil moisture and nutrient status can be treated through irrigation and fertilization, but this type of intensive management has rarely been attempted on Crown range. Some Community Pasture Associations have occasionally used fertilizer.

CHAPTER C3

CONDITION OF THE RECREATION RESOURCE

The forest resource contains a number of interdependent elements - soil, water, flora, fauna, etc. - which occur in various combinations producing a resource base that can be harvested in many different ways. Deriving physical or mental satisfaction or refreshment through a recreational experience from direct or indirect contact with the forest is one form of harvesting, or using, the forest resource.

Recreation resources can be natural or man-made features or values which are capable of generating some sort of recreational experience. Forest or wildland recreation is based on features or values that are part of the forest or wildland environment. They may be physical, geological, topographic, hydrological (e.g. caves, mountains, glaciers, lakes and rivers), biological (e.g. plants, plant communities, fish, wildlife), cultural (e.g. historic sites, trails, various man-made features), or abstract (e.g. visually pleasing aesthetic characteristics). These features support a wide variety of experiences from the passive pleasure of looking at a view to the active pleasure of shooting rapids in a kayak.

Defining the source of satisfaction derived from the multitude of forest recreational experiences is difficult. It is generally agreed that at least some of the pleasure is derived from a feeling of balance and continuity, the challenge of self-reliance and the feeling of freedom.

Virtually all forest, range and alpine lands contain some feature or value capable of generating a recreational experience. The protection and management of such features is part of the Ministry of Forests' integrated management mandate on some 85% of provincial land. The remaining 15% is made up of private lands and lands managed by other ministries. Provincial and National Parks and ecological reserves belong in the latter category.

For lands under the Ministry of Forests' jurisdiction, achieving sustained productivity of the renewable resources is the basic objective. Recreational use, being part of the overall resource management objective, is to be integrated with other resource utilization activities.

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USE OF THE RESOURCES

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CHAPTER D1

TIMBER HARVEST STATISTICS

The timber harvest statistics presented here are a continuation of those reported in the 1979 Resource Analysis and encompass the years 1978 through 1984. To enable a common reporting format they are compiled by fiscal year.

Administrative jurisdiction over the Midcoast Timber Supply Area (TSA) is being transferred from the Prince Rupert Forest Region to the Vancouver Forest Region. The Midcoast timber harvest statistics have therefore been included in the Vancouver region for the full period, 1978-79 through 1983-84. This accounts, in large part, for the reported increase in the Vancouver region harvest (approximately 1 million m³ per year) since the 1979 Resource Analysis and the decrease in the Prince Rupert Coast harvest, although the loss of the Midcoast harvest is almost compensated for by increases in the harvests from other TSAs within the region.

Base data for the 1978-79 and the 1979-80 fiscal periods were extracted from the corresponding Ministry of Forests Annual Reports. Because Annual Reports before 1980 provide information on a calendar-year rather than a fiscal-year basis, these data have been adjusted to fit the appropriate fiscal periods. To allow the adjustment to be made readily, monthly billed volumes were assumed to be uniform. So, for example, 75% of the totals reported in the 1978 Annual Report and 25% of those presented in the 1979 Annual Report have been combined to produce the statistics for the 1978-79 fiscal year.

Volumes reported for the Prince George and Prince Rupert Forest Regions were divided among the four corresponding Resource Analysis regions by applying the following factors to total volumes for the 1978-79 and 1979-80 fiscal periods:

Prince George Northeast	:	17%
Prince George	:	83%
Prince Rupert Interior	:	50%
Prince Rupert Coast	:	50%

These factors represent averages of actual volume distribution for the fiscal years 1980-81 through 1983-84. Data for the fiscal years 1980-81 through 1983-84 were taken from summary reports of volume billed.

These reports presented the information by species within each TSA, which generally facilitated dividing volumes harvested in the Prince George and Prince Rupert Forest Regions among the four associated Resource Analysis regions. However, in some cases, volumes were reported without the TSA's number. To address this problem, unidentified TSA data were assumed to be allocated in the same average proportions as identified TSA data. Table D-1 shows the factors used.

Table D-1. Volume Apportionment Factors

Resource Analysis Regions	Fiscal Years			
	1980-81	1981-82	1982-83	1983-84
Prince George Northeast	15%	17%	17%	18%
Prince George	85%	83%	83%	82%
Prince Rupert Interior	48%	50%	58%	61%
Prince Rupert Coast	52%	50%	42%	39%

The following tables provide a commonly formatted, continuous picture of timber harvest over the period since the 1979 Resource Analysis. Table D-2 shows the total volumes harvested from each region from 1978 to 1984. Table D-3 shows the average volumes harvested, by species, for the whole period.

Table D-2. Total Volume Of All Products[1,2] Billed By Region

Region	Volume (thousands of m^3)					
	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84
Cariboo	7,469	6,504	7,347	6,518	7,283	7,566
Kamloops	8,908	8,813	8,437	9,592	7,282	9,131
Nelson	7,255	6,904	6,350	5,465	5,649	6,993
Prince George Northeast	2,454	2,630	1,918	1,976	2,425	3,151
Prince George	11,473	13,355	11,213	10,632	11,699	14,518
Prince Rupert Interior	4,766	5,763	5,542	5,273	4,754	7,060
Prince Rupert Coast	4,766	5,764	6,610	5,078	3,224	4,211
Vancouver	28,190	26,462	25,167	18,091	18,626	25,078
TOTAL	75,173	76,195	72,584	62,625	60,942	77,708

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[1] Includes firmwood rejects.

[2] Includes all harvesting on Crown, private and federal lands and Indian Reserves.

Table D-3. Species Cut, All Products,[1,2] Annual Average over the 1978-79 Through 1983-84 Period

Volume of Harvest

(thousands of cubic metres)

Region	Balsam	Cedar	Cypress	Fir	Hemlock	Lodgepole Pine	Spruce	White Pine	Other Species	Total
Cariboo	330	160	-	1,349	19	3,034	1,931	-	19	6,842
Kamloops	951	523	1	1,514	260	2,401	2,236	45	123*	8,054
Nelson	566	776	-	700	565	1,797	1,522	180	275*	6,381
Prince George Northeast	138	6	-	18	1	617	1,884	-	6	2,670
Prince George	1,346	6	-	271	15	4,317	7,013	-	32	13,056
Prince Rupert Interior	839	223	16	13	852	1,984	1,618	2	26	5,573
Prince Rupert Coast	507	742	80	13	2,030	456	988	2	28	4,846
Vancouver	4,442	5,084	639	3,295	9,313	117	435	67	67	23,474
Totals	9,119	7,576	751	7,173	13,055	14,723	17,627	296	576	70,896

[1] Includes firmwood rejects.

[2] Includes all harvesting on Crown, private and federal lands and Indian Reserves.

* Predominantly larch.

In response to the world-wide recession, provincial timber harvest levels declined 17% between 1979/80 and 1982/83 (see Figure D-1), with the coastal harvest sustaining a far greater drop than the interior.

Throughout the entire period, the ranking of the four species groups that contributed the most to the provincial harvest remained the same. The spruce group consistently ranked first averaging about 16 million m³ (25% of the provincial harvest), followed by lodgepole pine, hemlock and balsam (see Figure D-2).

Private timber (including both managed and unmanaged lands, as well as Indian Reserves) and harvests from timber licences make a large contribution to the provincial harvest relative to the land area involved. During the period 1978-79 through 1983-84, they jointly produced an average annual volume of some 19 million cubic metres which is about 27% of the provincial harvest.

The majority of private timber and areas under timber licence are located on the coast, primarily within the Vancouver region. There the average annual harvest during the 1978-79 to 1983-84 period was some 16 million cubic metres, or 80% of the total provincial private timber harvest.

Within the private land category the average annual harvest from unmanaged lands represents roughly 64% of the total. Managed lands and Indian Reserves comprise the remainder at 35% and 1% respectively.

Figure D-1

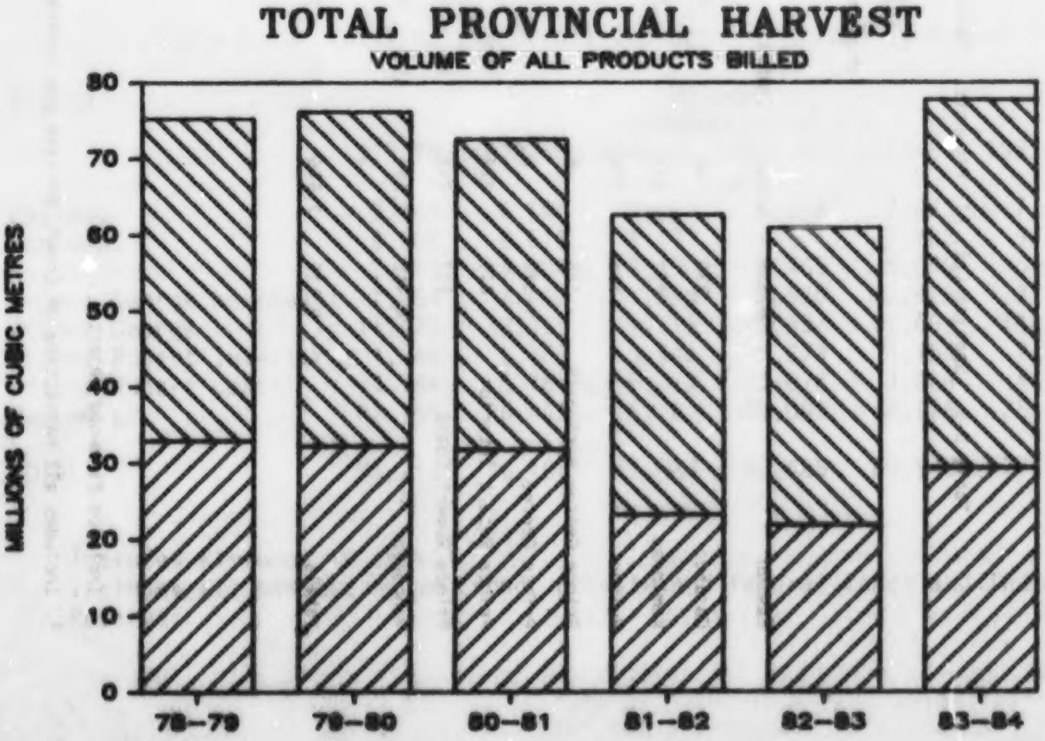
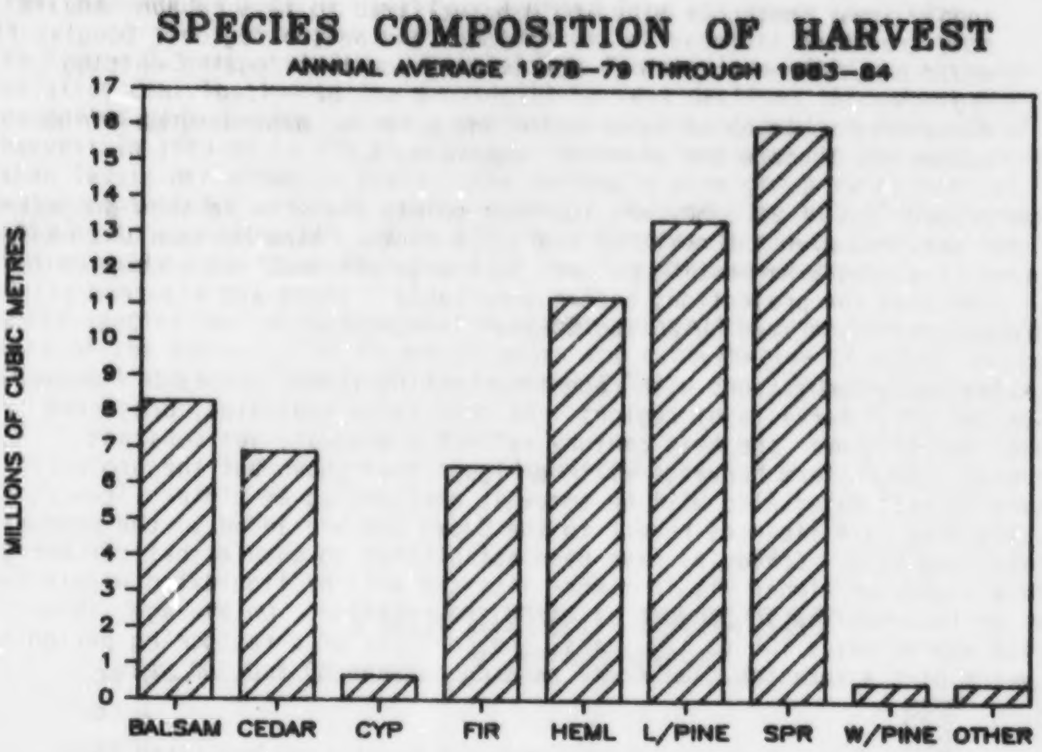


Figure D-2



PATTERN OF FUTURE HARVESTS

Future harvests were predicted by using the linear programming model 'Multiple Use Sustained Yield Calculation' (MUSYC). Current harvest levels and management practices were applied to the provincial growing stock to project timber harvest by major species groups over the next 20 decades.

The model was developed using the following assumptions:

- no losses would result from fire, insects or disease;
- stands would regenerate to the same species unless otherwise indicated;
- planting would produce no gains in volume;
- harvest levels would not increase above the current AAC or decline below the long run sustainable yield (LRSY) except in a few cases where the LRSY exceeded the allowable annual cut;
- harvest levels would not fluctuate more than 10% per decade;
- current harvest profile could change to the inventory profile by the fifth decade, after which time no constraints were placed on the selection of species;

- utilization levels would be to 22.5 cm at breast height (dbh) on the coast and to 17.5 cm dbh in the interior, except in some interior timber supply areas lodgepole pine would be utilized to 12.5 cm dbh, and in some tree farm licences in the Kamloops and Nelson regions, Douglas-fir would be utilized to 27.5 cm dbh to incorporate selective cutting regimes;
- harvesting would be at culmination age or older depending on minimum volume per hectare and diameter requirements.

Three projections of 20-, 50- and 100-year points are used to show projected harvest patterns over the next 100 years. A century time horizon was chosen because it allows a harvesting pattern to emerge yet does not encompass so much time that the projections become unreliable. Short and mid-term planning horizons are illustrated by 20 and 50 year 'snapshots'.

To allow ready comparisons with recent harvesting trends, Table D-4 shows projected total harvests by regions. As this table indicates, projected timber harvests over the next century reflect a gradual, yet constant, decrease. Short term harvests will be higher than shown but the projected future harvest rates also will be somewhat ameliorated as timber licences outside tree farm licences revert to the Crown and are added to the productive forest land base. Schedules have been established to ensure that currently mature stands of timber within timber licences will be liquidated within the time period required to produce a second growth stand. On average, this period approximates 100 to 120 years, and consists of a restocking period of 20 years plus a rotation time frame ranging between 80 and 100 years.

Table D-4. Projected Timber Harvest Level From Regulated Lands

Region	Volume (thousands of cubic metres)		
	After 20 Years	After 50 Years	After 100 Years
Cariboo	2,680	2,680	2,660
Kamloops	8,214	7,515	7,662
Nelson	4,018	4,213	3,754
Prince George Northeast	2,704	2,960	2,893
Prince George	13,460	12,624	12,859
Prince George Interior	6,099	6,093	5,639
Prince Rupert Coast	4,663	3,771	3,510
Vancouver	21,620	18,633	17,136
Totals	63,458	58,489	56,113

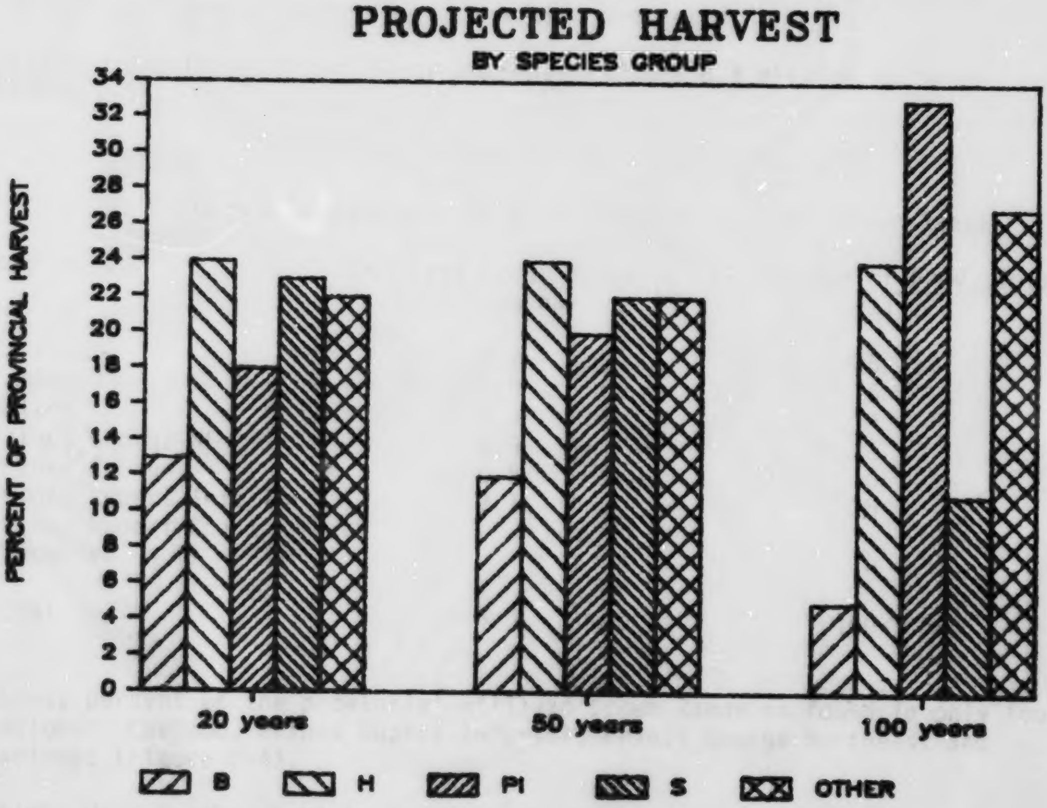
* This table does not include harvesting on private and federal lands and Indian Reserves

Thus, the projected harvest at each time interval will be higher than shown but only the current harvest of private timber is known with any certainty. This source of timber is therefore omitted from all three scenarios.

As Figure D-3 shows, balsam maintains its fourth place ranking, although its relative contribution to the provincial harvest declines throughout the projected period. The spruce groups show a constant decline from 25% of the harvest in 1983-84 to 11% in 2083-84. Hemlock increases in the near term and then levels off after 20 years. The lodgepole pine group takes over as the major contributor after 50 years, moving from producing 20% of the harvest in 1983-84 to approximately 33% in 2083-84. Species in the 'other' column individually rank lower than the four species discussed above.

Other species including Douglas-fir, cedar and yellow pine form a significant part of the harvest. At 20 and 50 years the contribution of other species is about 22% and after 100 years it is about 27%.

Figure D-3



The Multiple Use Sustained Yield Calculation Model uses current harvest statistics to set the stage for future harvesting patterns. So, current contributions by species groups to the regional harvest constitute the initial data set from which the model grows the forest through time. Current harvesting strategies ensure that the species composition of the projected harvest in the first two decades maintains the status quo. Between the 20th and 50th years this influence wanes and the projected harvest is allowed to more closely approximate the actual inventory profile. After the 50th year, controls are lifted from the running of the model. From then on, the projected harvesting pattern will likely continue to align itself with the species profile of the inventory as the forest industry adjusts to accept whatever supplies are available.

The model must be allowed to adjust the harvest pattern to fit the inventory profile because adherence to current harvesting strategies over an extended period would exhaust supplies of preferred species. The increase in the harvest of lodgepole pine groups after the 5th decade likely results exclusively from the ingrowth of immature pine as reflected in the inventory profile.

CHAPTER D2

RANGE USE STATISTICS

A comprehensive body of range resource information was compiled for this report. These data relate to the 1983 calendar year and establish the extent of the provincial Crown range resource and the degree to which it is used. Information has been drawn from reports which present data by Range Unit within TSAs and then accumulated to produce regional summaries and finally the provincial picture.

In addition to providing base information regarding the range resource and the uses which bear upon it, levels of use of each of the 14 provincially identified "General Range Types" are also presented.

Utilized provincial Crown Range encompasses some 8.3 million hectares (Table D-5).

Table D-5. Distribution of Utilized Provincial Crown Range

Region	Utilized Crown Range (millions ha)	Percentage of Prov. Total (%)
Cariboo	2.2	26
Kamloops	1.3	16
Nelson	0.3	4
Prince George NE	1.9	23
Prince George	0.5	6
Prince Rupert Interior	2.1	25
Prince Rupert Coast	-	-
Vancouver	-	-
Total	8.3	100

Ninety percent of the provincial utilized Crown Range is found in only four regions: Cariboo, Prince Rupert Interior, Prince George Northeast and Kamloops (Figure D-4).

Animal Unit Months (AUM) is an indictor of the capacity of the range to support production. This measure is generally viewed as the area required to sustain a cow and calf for a month duration. The actual use of the utilized Provincial Crown Range in 1983 was some 924,000 AUMs (Table D-6).

Figure D-4. Regional Distribution of Utilized Provincial Crown Range

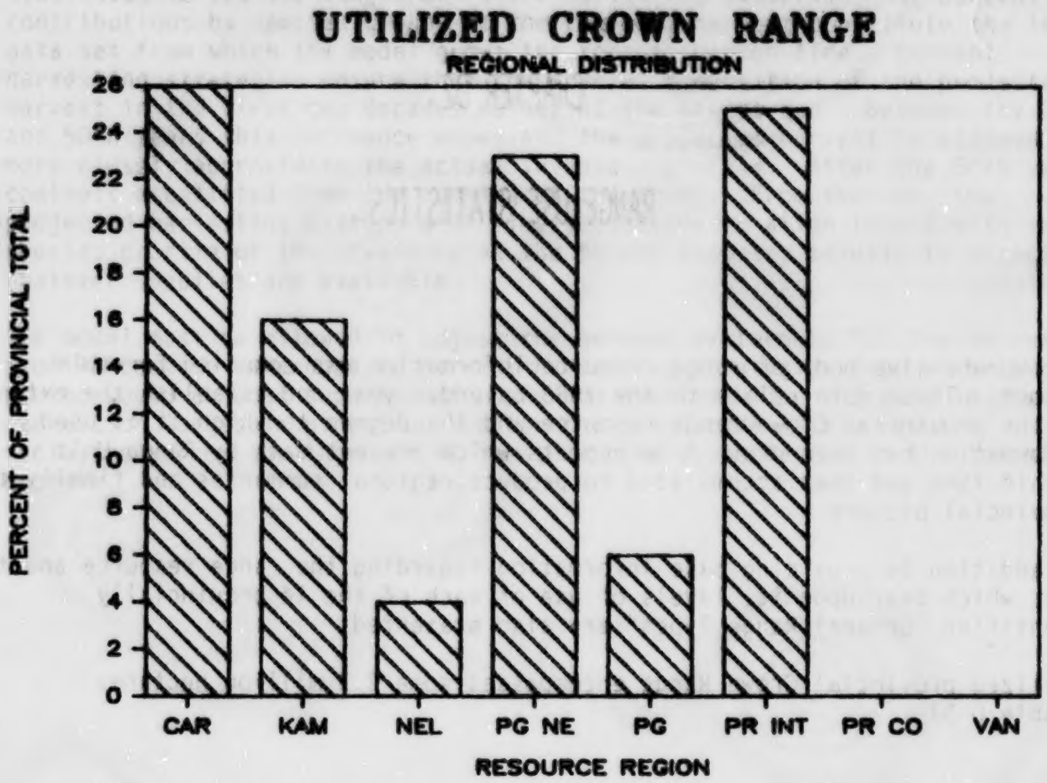


Table D-6. Extent of Utilization of Crown Range

Region	Actual Use (AUMs)	Percent of Provincial Total (%)
Cariboo	360,295	39
Kamloops	343,941	37
Nelson	78,585	9
Prince George NE	95,348	10
Prince George	35,952	4
Prince Rupert Interior	5,551	1
Prince Rupert Coast	-	-
Vancouver	1,450	-
Total	924,122	100

The Cariboo and Kamloops regions support the greatest levels of actual grazing use comprising some 76% of the provincial total. Although both the Prince Rupert Interior and Prince George Northeast regions including sizeable amounts of Crown range classed as utilized, actual use is low.

The total number of utilized AUMs on Provincial Crown land is widely dispersed. There is a great variety in the propensities of range habitat types to support the production of cattle. The fourteen provincially identified general range types are as follows:

1. Open Range
2. Wetlands
3. Alpine
4. Ponderosa Pine Forest
5. Dry Forest
6. Lodgepole Pine Forest
7. Wet Forest
8. Deciduous Forest
9. Transition Forest
10. Clearings
11. Non-vegetative Cover
12. Brush
13. Urban
14. Alienated

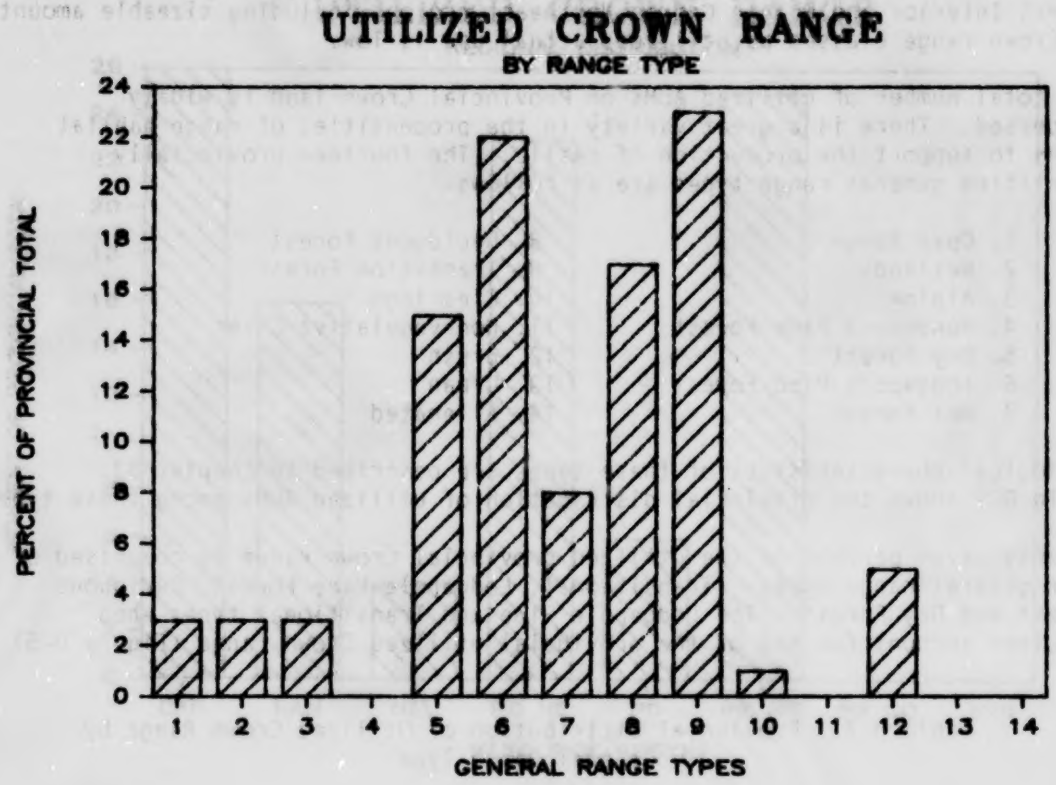
Ecological characteristics of these types are described in Chapter B3. Table D-7 shows the provincial distribution of utilized AUMs among these types.

Seventy-seven percent of the utilized provincial Crown range is comprised of four general range types: Transitional, Lodgepole Pine Forest, Deciduous Forest and Dry Forest. The Lodgepole Pine and Transitional types when combined account for 45% of the provincial utilized Crown range (Figure D-5).

Table D-7. Provincial Distribution of Utilized Crown Range by General Range Type

General Range Type	Utilized Crown Range	Percent of Provincial Total
	(millions ha)	(%)
1. Open Range	0.2	3
2. Wetland	0.3	3
3. Alpine	0.3	3
4. Ponderosa Pine Forest	–	–
5. Dry Forest	1.2	15
6. Lodgepole Pine Forest	1.8	22
7. Wet Forest	0.7	8
8. Deciduous Forest	1.4	17
9. Transitional	1.9	23
10. Clearings	0.1	1
11. Non-vegetated	–	–
12. Brush	0.4	5
13. Urban	–	–
14. Alienated	–	
Total	8.3	100

Figure D-5. Distribution of Range Utilization by Range Type



How completely the available Crown range is being utilized is addressed in Table D-8.

Of the available general range type areas, the most extensive use is being made of Open Range, Clearings and Ponderosa Pine Forest. That does not mean, however, that a large surplus capacity exists in the other types. As discussed in Chapter C2, there are numerous limiting factors to constrain further utilization. The present level is judged to be near maximum unless management efforts are increased and, even then, it would be unrealistic to expect to boost utilization in many of the range types.

Table D-8. Utilization of the Available Crown Range

General Range Type	% Available Area of Type Utilized
Open Range	65
Wetland	16
Alpine	1
Ponderosa Pine Forest	55
Dry Forest	34
Lodgepole Pine Forest	19
Wet Forest	3
Deciduous Forest	37
Transitional	22
Clearings	57
Non-vegetated	-
Brush	21
Urban	25
Alienated	-

CHAPTER D3

RECREATIONAL USE STATISTICS

This chapter presents the information available on the types and amounts of recreational activities that occur on Crown land. Some types like downhill skiing and organized camping are tied to developed facilities. Others, like picnicking, hiking, ski touring, fishing, hunting and kayaking are unstructured and are pursued in any area available for the purpose. In British Columbia, structured facility-oriented recreation is generally provided by municipal, provincial or federal park agencies. Unstructured activities, because they take place on Crown land, are generally managed by the Ministry of Forests.

Information on the type and amount of recreational use in the province is uneven. Some agencies, like the Fisheries and Wildlife Branches of the Ministry of Environment and some organized user groups, have comprehensive statistics covering their field of interest; and the Ministry of Forests has reliable information regarding overall use of developed Forest Service recreational sites. But information on the amount and type of recreational activities overall on Crown lands is incomplete.

Quantified information on general outdoor recreational activities such as hiking, picnicking and boating on Crown lands outside parks is unavailable. Therefore the figure of 2 million in Table D-9 is based on user estimates. However, during 1981 over 16 million days were devoted to such uses within provincial parks alone, so the figure is likely conservative.

As shown in Table D-9, a total of 11 million user days per year are spent pursuing eight specific activities. These figures do not include such major activities as driving for pleasure or using terrain vehicles. These activities along with some others that are unaccounted for are estimated to increase the total figure to about 13 million user days.

The figure of 1.7 million user days for recreational sites comes from a Ministry of Forests study on use carried out between 1981 and 1983. This study also found that over 80% of the user population comes from British Columbia.

Although some areas are consistently heavily used (mainly near population centres), the site use patterns are highly dynamic. They change dramatically from one year to the next depending on changing fish stocks, road conditions, weather and local economic conditions and other conditions.

The use of trails managed by the Ministry of Forests is estimated at 300,000 user days per year. Winter use, especially for cross-country skiing, makes up a substantial part of this total. In fact, winter use is increasing, creating an added load on the Ministry's Recreation Program.

Table D-9. Recreational Use of Crown Lands Under Ministry Jurisdiction in Some Specific Activities

Type of Activity	Total Use (User Days)	Remarks (eg. year of focus)	Agencies & Source of data
FS Sites & trails	1,700,000 300,000		Maintenance records estimates
Hunting (pr)	1,446,265	1982(80 & 81 available)	Ministry of Env. Fisheries
Hunting (fed)	28,243	'81 hunter survey	Can. Wildlife Service
Fishing (pr)*	5,977,900	1980 national survey	Min. of Env. Fisheries
Canoeing & * Kayaking	198,375 7,935	1983-derived from 1981+ 15% annually	Brian Creer user group rep.
River * Rafting	31,800 43,400	Growth rate -20% Growth rate -30%	River Rafting Study (TIDSA)
Snowmobiling	995,000	No growth in past 3 years	B.C. Snowmobile Federation
Horseback * riding	47,000	1983-derived from 1981+ 15% annually	Horse Council of B.C.
Other General Outdoor Recreation (camping, hiking picnicking & undetermined)	2,000,000**		

Notes: *There is no basis for separating the proportion of these activities pursued within Parks and on open Crown land. Based on available Park visitor data, there are some additional 16 million days of overall use in Provincial Parks.

**This is a rough estimate based on the best comments available from user groups.

Although the information on recreational use of Crown lands is incomplete, it is sufficient to allow some conclusions to be drawn:

1. Forest Service site-oriented use represents a relatively small portion of total recreational use of the forest land base (see Table D-9). This validates the ministry's stress on developing low-key, rustic sites requiring minimum terrain modification and minimum capital investment. It also emphasizes the importance of protecting and maintaining recreational values on all forest lands.

2. The ministry must identify areas with consistently high-site and facility-oriented use (such as parts of the lower mainland and other locations near major population centres) and explore the possibility of involving other agencies such as municipalities and regional districts in the management of such high-use areas. Program resources are currently unable to handle this responsibility.

3. With the continued improvement in all-terrain vehicle technology and the corresponding increase in cross-country mobility, access philosophy and attendant policies and regulations need to be developed. Use conflicts will need to be resolved with as little infringement as possible on the rights and freedom of the users.

4. If the ministry adheres to its integrated management commitment, the available forest recreational opportunities will generally continue to outweigh the demand within the 20-year planning horizon in both accessed and nonaccessed areas.

The number of outdoor recreational facilities under the jurisdiction of the Ministry of Forests are shown in Figures D-6 and D-7. Table D-10 shows the capacity of facilities the ministry manages. These include rustic recreation sites and recreation trails. The table also shows the ministry's data on the number and kind of unmanaged trails.

Many agencies, organizations and individuals provide and maintain recreational facilities. Table D-11 illustrates the extent of their involvement. It shows how many rustic sites, higher-standard sites and recreational trails they manage. The majority of these facilities tend to attract a different user group from those using ministry facilities and thus do not alleviate the pressures on the ministry's site and trail operations program.

Together, Tables D-10 and D-11 indicate the high public demand for outdoor recreational facilities.

The 1979 Resource Analysis projected that by 1985, use of Forest Service facilities would be what it is today: 2 million user days. At that time, projections indicated that the capacity would be increased to 13,000 vehicle units by 1985. The current capacity of actively maintained Forest Service Recreation sites is 9,125. This shortfall means that, in some locations, environmental, safety and sanitary conditions are deteriorating depending on the intensity of use.

Because managing sites and trails on Crown land implies a certain level of ministry responsibility when safety and sanitary conditions fall below an acceptable level, there can be no choice but to close the location and discourage public use. In the past two years, gradual deterioration has resulted in 10% of the sites being closed and further closures can be expected.

The experience of the past 12 years has shown the futility of attempting to estimate trends in types and quantity of future recreational use for any period over 5 years. We can only assume that the percentage of the population participating in forest-oriented recreation will remain the same. Consequently, the only way to estimate increases in number of user days is to extrapolate from overall increases in population.

Table D-10. Facilities Managed by the Ministry of Forests, Fiscal Year 1983-84

Region	Rustic Recreation Sites		Recreation Trails			Known Unmanaged Historic Trails	Known Unmanaged Recreation Trails
			Non-motorized Only	Motorized Vehicles Permitted	Total		
	(No.)	(Vehicle Capacity)	(km)	(km)	(km)	(km)	(km)
Cariboo	154	1,281	162	92	254	880	*
Kamloops	317	2,995	574	614	1,188	211	*
Nelson	234	1,092	952	75	1,027	249	*
Pr. George N.E.	18	145	49	24	73	150	651
Pr. George	158	1,290	325	151	476	207	390
Pr. Rupert Int.	68	664	52	-	52	537	435
Pr. Rupert Coast	9	125	-	-	-	209	54
Vancouver	133	1,533	27	208	235	177	650
TOTALS	1,091	9,125	2,141	1,164	3,305	2,620	2,180

* No figures available

Table D-11. Facilities Managed by Other Agencies (Provincial Summary)

Agency	Sites				Trails		
	Rustic		Higher Standard		Motorized Use	Nonmotorized Only	Total
	No.	Capacity (V.U.)	No.	Capacity (V.U.)	(km)	(km)	(km)
Min.Lands, Parks, & Housing	28	845	180	9,129		1,621	1,621
Min.Highways & Trans.	19		51	500			
Federal				13	1,321		
Regional Dist.	6	64	26	536	212	19	231
Towns & Indian Bands	17	261	30	1,326	15	88	103
B.C. Hydro	2	50	1	40			
Private				681*	28,010		no data
Totals	72	1,220	982	40,862	227	1,728	1,955

* These numbers are made up of 119 fishing/hunting camps with a capacity of 1,054 units and 562 campground/trailer parks with a capacity of 29,956 units.

Assuming that the Ministry's objectives remain unchanged, the increase in recreational use of Crown forest and wildlands will be approximately 4% per year. In terms of total dispersed use of forest lands, this means an annual increase of half a million users. For Forest Service recreational site-oriented use, the yearly increase will be about 75,000 user days.

Figure D-6

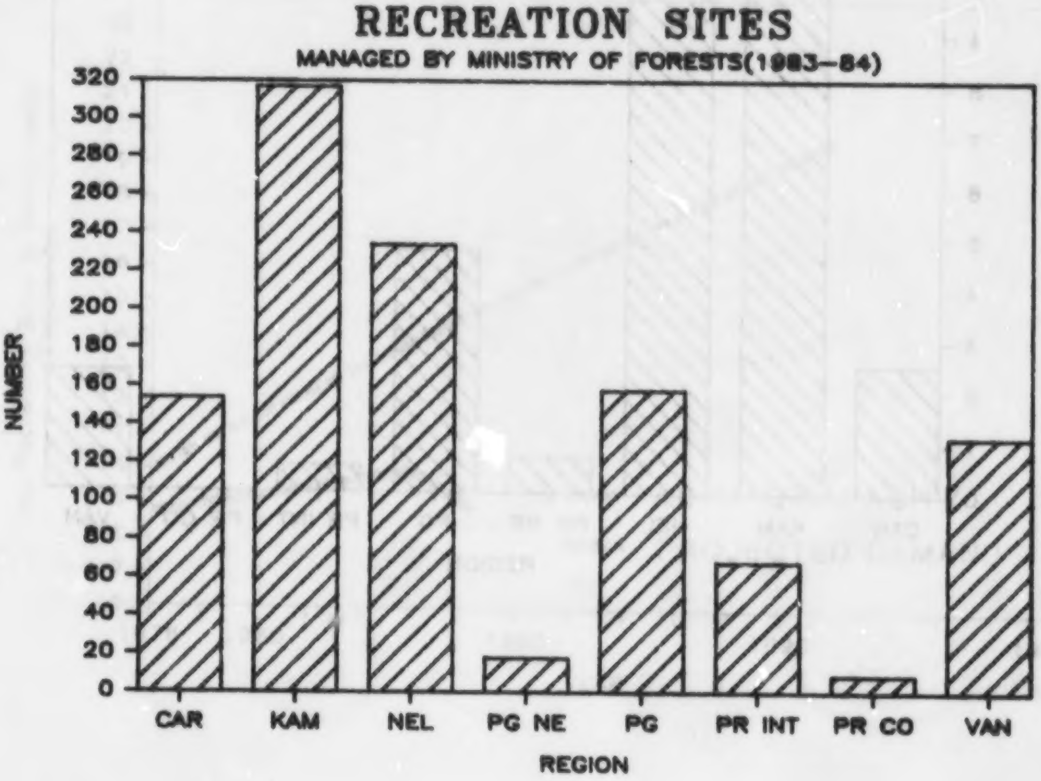
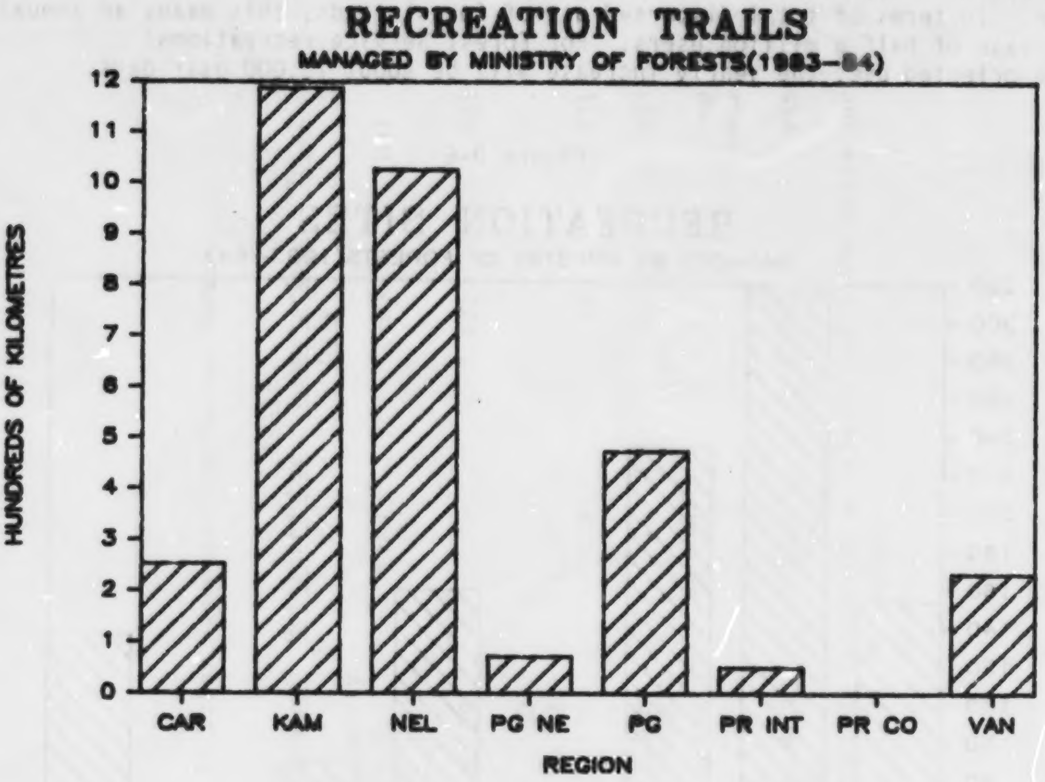
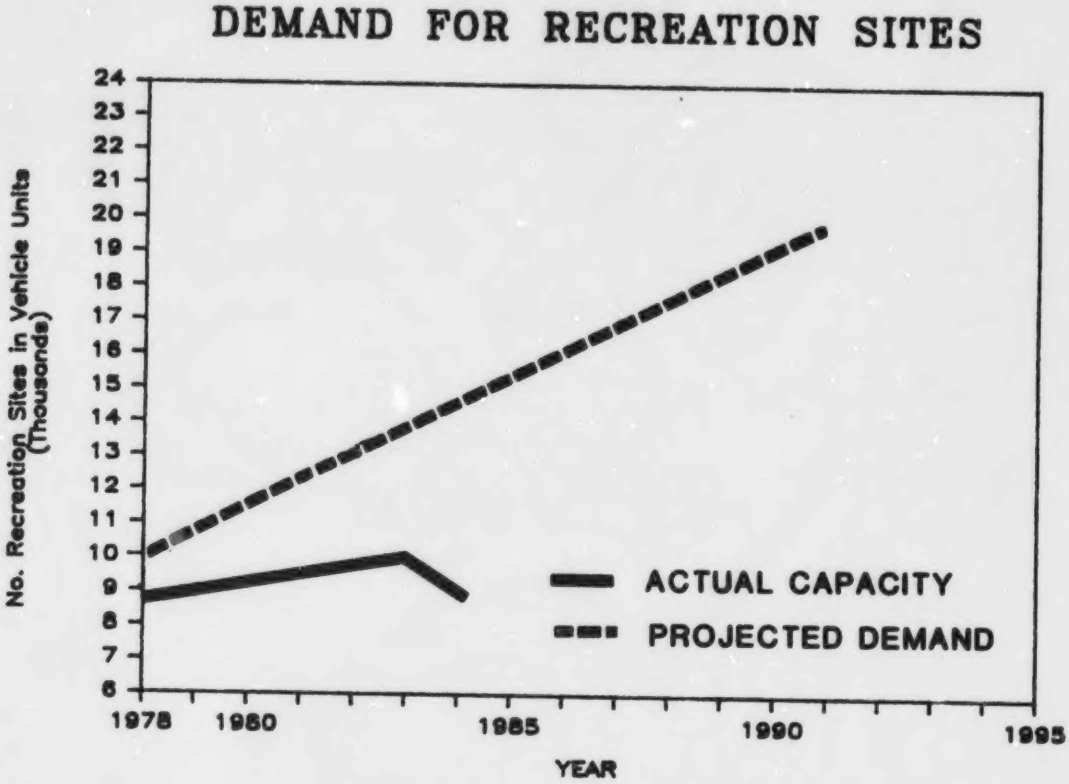


Figure D-7



The following graph (Figure D-8) indicates the current capacity and projected need for Forest Service Recreation Sites.

Figure D-8. Projected Need for Ministry of Forests Camp Sites



* A vehicle unit is a measure of a site's capacity to accommodate use. It identifies the number of average-sized parties a site can accommodate per day without the site or the intended recreational experience deteriorating. For sites without vehicle access, the conversion used is 2.95 user days = 1 vehicle unit.

** 1984 figures are not yet final.

SECTION E

MINISTRY OF FORESTS PROGRAMS

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CHAPTER E1

OVERVIEW OF THE MINISTRY OF FORESTS' MANDATE AND GOALS

The official mandate of the Ministry of Forests is set out in three interlocking pieces of legislation: the Ministry of Forests Act, the Forest Act and the Range Act. The Ministry of Forests is formally established by the Ministry of Forests Act, which also sets an administrative framework that conforms to standard legislative practices in the province. It is a written mandate specifying the ministry's major objectives and powers. These cover all matters relating to Crown forest, range and recreation resources with the exception of any matters specifically assigned to other ministries or agencies of the provincial government.

The basic objectives of the ministry are established in Section 4 of the Ministry of Forests Act:

> ..."to:
>
> (a) encourage maximum productivity of the forest and range resources in the Province;
>
> (b) manage, protect and conserve the forest and range resources of the Crown, having regard to the immediate and long term economic and social benefits they may confer on the province;
>
> (c) plan the use of the forest and range resources of the Crown, so that the production of timber and forage, the harvesting of timber, the grazing of livestock and the realization of fisheries, wildlife, water outdoor recreation and other natural resource values are coordinated and integrated, in consultation and cooperation with other ministries and agencies of the Crown and with the private sector;
>
> (d) encourage a vigorous, efficient and world competitive timber processing industry in the Province; and
>
> (e) assert the financial interest of the Crown in its forest and range resources in a systematic and equitable manner."

Towards these ends, the ministry is empowered to enter into all necessary agreements and cooperative arrangements with the federal government, other provinces and various public and private agencies.

The balance of the ministry's mandate is contained in the Forest Act and the Range Act, which together give the authority to manage all Crown forest and range resources in the province. The Forest Act in particular lays the foundation for a systematic decentralization of administrative authority and functions within the ministry thereby increasing efficiency and flexibility. In addition, these Acts define the overall framework within which the public and private interests in resource management will be accommodated. They are designed to provide incentives, in the form of long-term tenures and operating privileges, to those who practice good resource management, while penalizing those who violate the standards established by the ministry.

Aside from the general goals outlined in the legislation, ministry goals are not specified explicitly except through policies and regulations. This means direction must be discerned from the collective effects of these decisions, which comprise several volumes. These formal ministry policies are routinely developed by branches at headquarters and then authorized by the deputy minister. Informal and unwritten policies also play a large part in the ministry's operations. These constitute established practices and procedures that have evolved in response to perceived objectives in managing and administering the resources, but are not captured in total in published policy manuals.

This chapter does not reiterate the vast set of policies but explores some of the main underlying goals and concepts. These should assist in understanding the purposes of individual programs, which are described in Chapter E4. Ten fundamental goals will be discussed here:

Sustained Yield

1. The timber resource will be harvested on a sustained yield schedule.

Conservation of Grazing Land

2. Grazing will be regulated to a level that maintains range quality and ecological integrity.

Aesthetic Values

3. Aesthetic values of the forest resources will be recognized and public right of access to enjoy them will be ensured.

Integrated Management

4. Timber harvests will be integrated with protection and management of other resources to achieve optimal benefits from all resources.

Community and Employment Stability

5. Decisions about use of the timber resource will recognize community and employment stability as prime considerations.

Security of Supplies

6. Rights to harvest and utilize grazing opportunities will be granted under a set of tenure provisions that allows the industries sufficient security of supply to plan long-term investments in infrastructure, resource improvements, equipment and manufacturing plants.

Fair Price for Crown Resources

7. **The price charged for timber and grazing rights will reflect the Crown's right to a fair market value for its resources.**

Efficient Development of Management Unit

8. **Management unit planning and development will recognize short-term and long-term needs of the forest industry and independent communities.**

Harvesting Practice

9. Harvesting practices will be selected, not only to allow efficient removal of mature timber, but also to recognize the needs of other resource users, to meet requirements for site protection and to allow successful reestablishment of a suitable forest stand.

User Participation

10. Within the overriding mandate of the ministry to protect the Crown's interest in the timber and range resources, decisions will be delegated as close to the operational level as possible to ensure that the needs of the forest and ranching industries and other resource users can be incorporated into management choices. Similarly, the maximum possible management responsibility will be delegated to the forest industry to capitalize on professional capabilities and management skills.

Each of these goals is discussed below.

SUSTAINED YIELD

Sustained yield became a governing precept of forest management in British Columbia following the 1945 Royal Commission on Forest Resources. It is now embodied in the Forest Act; but it still eludes precise definition and is notably missing from the Act's interpretation section (Section 1). Evidence of confusion is found in editorials about the state of forest management in British Columbia, in the concern over "falldown", the declining harvest rate, and in endless arguments about land base allocation and resource use tradeoffs. A clear definition is therefore essential to a full understanding of forest management as it is practised today.

British Columbia's forests are commonly thought to be managed under a policy of constant production over time. This is not true. Many future second-growth stands will yield smaller harvests at maturity than the existing old-growth forests. Application of the sustained yield concept must, therefore, allow for making a transition from using an accumulated inventory of mature timber to relying on annual production from second growth. The general trend is downward to a "sustainable" level unless productivity is enhanced through more intensive management.

Confounding the rationing process are changes in what is defined as usable timber and in the land base that will be available for timber production. The former has increased immensely over the past three decades as more of each tree is used, as smaller trees and a wider range of species out of each stand are accepted for harvesting, and as stands previously considered technologically or economically inoperable are logged. Both the harvesting and manufacturing sides of the forest industry have therefore been able to expand under a policy of sustained yield even without additional wood being grown.

However, the trend toward greater utilization made possible by technological innovation has slowed as logging has progressed into lower-valued stands and more difficult operating conditions. A notable exception is recent acceptance of small-diameter timber, especially lodgepole pine, for lumber production in interior regions. Approved harvest rates already incorporate this shift.

In a different category is what is often termed incentive wood, which is beyond current utilization levels, either in unused portions of stems or in a species, quality or size not anticipated to be logged in the foreseeable future. The Forest Act, Section 52b, makes provision for its harvest by anyone who can do so economically, but it is not included in sustained yield calculations. If, at some future date, a larger demand develops for this wood to the point that it can realistically be termed harvestable, it will then be incorporated into the long-term timber supply base.

Even without considering incentive wood, defining a timber supply for sustained yield management is subject to speculation. Because of the long time horizon involved, judgements must be made regarding which timber categories will prove harvestable, considering possible changes in market prices, harvesting technology, cost and products. The past policy was "bullish" in that it relied on rapidly improving technology to allow utilization of marginal timber categories as required in the future. That policy prevailed until the mid-1970's when constraining forces on wood supply began to outstrip expanding forces. The 1979 Resource Analysis emphasized that, over most of the province, the above policy would result in serious, long-term consequences for timber supply. It also identified a declining trend in wood supply unless significant investments were made in intensive silviculture.

Since then, future supplies have been viewed more conservatively. Harvest projections are based on timber supplies that could be utilized economically with existing technology at some time within anticipated market fluctuations. That means, in low or average markets, some of the wood supply will be inoperable, but in peak markets it will be operable. Any additional supplies made operable through improved utilization will be added to the sustained yield supply base if and when they are actually harvested. This will help offset predicted falldowns.

The size of the land base is a significant variable in the sustained yield policy. So many factors that contribute to its expansion or contraction are important.

Expansion is due mainly to inoperable stands becoming operable, which increases the net forest land base as a proportion of the gross. The relevant factors here have already been discussed under utilization level.

Contraction is due to forest land being allocated to other uses. Land with timber-growing potential is classified as forest land until it is in demand for a higher value use. Those demands will grow as the province develops and, thus, the land available for sustained timber production will be reduced. Depending on when the land is allocated to a nontimber use and on the type of use, one or more crops of timber may be produced in the interim.

In some land allocations such as parks and ecological reserves, mature forest is reserved from harvest and does not contribute to timber supplies; in others, such as hydro reservoirs, timber is harvested during clearing operations. Present assumptions about land use trends do not account for this distinction. When timber is harvested, it becomes available for the manufacturing industry, but it may or may not be considered part of the regulated supply from the management unit.

CONSERVATION OF GRAZING LANDS

The province's range lands are capable of producing valuable forage supplies for domestic stock and wildlife if properly husbanded, but they are very sensitive to management regimes. Of paramount importance in allocating rangelands is regulation against destruction by over-use. Not only can over-use reduce forage production by trampling and by inhibiting plant growth, it can upset ecological relationships in the plant community and alter the relative abundance of species. This affects carrying capacity for both cattle and wildlife.

Although the Range Management Program undertakes some improvement projects on rangelands, the primary focus is on conservation of natural productivity. The tenure system is designed to regulate overall grazing pressure and management prescriptions assure proper stock distribution and seasonal timing of use.

AESTHETIC VALUES

The forest is a pervasive feature in British Columbia, providing the physical setting for our settlements, travel-ways and recreation sites. Because of the topography, forests and the management practices applied to them affect the visual landscape over great distances.

No matter how carefully logging is done, the removal of mature timber from a forested hillside creates a highly visible and, to some, an unsightly disturbance in an otherwise uniform background. Gradually, as second-growth forests are established and the uniformity of old growth is broken, future disturbances due to logging will become less noticeable. For now, though, visual impacts are a very significant factor to be accommodated in forest management plans.

It may not be possible to hide logging but it can be made less obtrusive. Landscape logging techniques are being applied increasingly in visually sensitive areas. The Forest Landscape Handbook produced by the Ministry of Forests in 1981 embodies effective principles that can be applied to protect aesthetic values.

INTEGRATED MANAGEMENT

Integrated management is a fundamental goal embodied in the Ministry of Forests Act, but how it is to be practised is the subject of extensive debate. It is discussed at length in Section F, so will be considered here only in general terms. Interactions are among the three mandates within the Ministry of Forests - timber, range and recreation - and between Ministry of Forests' programs and the programs of other ministries.

In almost all integrated management situations, timber harvesting is the dominant active force. Effects can be positive or negative on other uses with the latter being the most frequent concern. As would be expected in areas of predominantly mature forest, established uses and values are those associated with the unlogged condition. Some logging may improve the ability of the forest to support those uses by adding access and variety to the mix of seral stages, but eventually the progressive alteration to the forest environment restricts established uses while sometimes facilitating new or future uses. Integrated use therefore can involve:

- altering logging prescriptions to optimize benefits to established users;
- mitigating the effects of logging; and
- facilitating the change in forest conditions to support new uses.

These might be incompatible and thus might require priorities to be set. Present emphasis is on the second.

The main variables in logging prescriptions are dispersal of activities, size of openings, time intervals between sequential removal of adjacent blocks, and location of roads and other infrastructure. An additional concern is the resulting age structure of the forest (the proportion of mature timber or the average age of the forest).

Some prescriptions can be met without detrimentally affecting sustainable timber production levels, although restrictions on the fraction of timber removed during first-pass logging imposed because of multiple-use considerations contribute to projected falldowns in a number of timber supply areas. Where selected areas are given priority for other uses, they are removed from the productive land base before yield analysis. On the remaining area, the principle effects of integrated management are on the cost of timber production and on the flow of Crown revenues. These are not easily quantified and are not addressed explicitly in management decisions. They are, however, implicit in any effort to optimize the use of resources. That is, any additional costs must be offset by commensurate benefits. It is through the collective judgement of resource managers from various disciplines, participating in a negotiating process, that prescriptions are formulated. Approval lies with the Ministry of Forests.

COMMUNITY AND EMPLOYMENT STABILITY

The forest industry is part of the economic fabric of communities throughout British Columbia. For many, it is the dominant activity; and even in multiple resource communities, it plays a major role. With this degree of economic dependence on the forest industry, it is only natural that forest management policy has evolved stabilizing mechanisms. These fall into two categories:

- those that ensure continuous availability of timber supplies over time; and
- those that dampen fluctuations in employment that could follow trends in the market for forest products.

The policy of sustained yield obviously belongs in the first category. Indeed, when boundaries are selected for sustained yield units, one of the primary considerations is the logical flow of supplies to the established industry, which in turn supports dependent communities. While it is impractical, for reasons discussed later, to manage for sustained yield around every community, by and large, the units are of a size that they avoid disruptions of supplies within localized zones or subregions.

Although wood supplies are harvested according to a regulated rate, this does not necessarily mean that the forest industry within that area will remain unchanged. Harvesting activities may shift sufficiently to require moving some logging operations or manufacturing plants, but these should stay within the managed unit. Beyond that, the forest products industry may change its characteristics by producing different products, consolidating ownership, centralizing operations, etc. These actions can have consequences outside the industry. For example, the public can be affected if a mill is closed in favour of expanding facilities in another community.

The Forest Act enables the Minister of Forests to intervene where unencumbered action by the forest industry would unduly affect the public interest. For example, a quota cannot be transferred from one owner to another without the minister's approval. This allows government to exert control over the degree of consolidation in the industry. The minister can also issue a licence that restricts the wood supply the mill can use.

The end result is that large production facilities that draw supplies from extensive areas throughout a timber supply area or beyond are quite stable in the long term. Although changes in processes or product mixes along with automation might affect the number of people employed, the plant can still be looked on as a continuing component of the community's economic structure.

Smaller plants and local logging operations are far less stable, especially where current timber extraction is highly concentrated in only one portion of a management unit. As these areas shift, so do the logging and milling operations, with consequent impacts on communities. These are frequently one-industry towns that in the past would have quietly faded away as the residents bore the costs and disruption of relocation. More and more, this scenario is viewed as unacceptable, so planners are devoting more attention to the objective of using resources to secure a more stable existence for these settlements.

Cut control is another policy that could be as important as sustained yield in promoting employment stability. This policy governs the amount of fluctuation permitted in the industry's annual harvests. After the allowable annual cut is set for a timber supply area, it is apportioned for disposition of cutting rights under various tenures as a finite annual quantity. Actual harvests, however, are permitted to vary from this by as much as 50% in any one year and by 10% over a five-year period to enable the operator to respond to the fluctuating market place.

SECURITY OF SUPPLIES

Crown ownership of forest and range resources means that a private user does not possess sole, long-term control. The tenure systems establish rights within prescribed time periods based on volume of timber supply, area authorized for use, or number of animals to be supported. They are discussed further in Chapter E2.

These tenures provide a measure of security of wood supply and thus convey sufficient confidence for investors to make necessary commitments in terms of capital improvements and operating facilities. As a consequence, there are fewer opportunities for new innovative firms to become established in the industry. The small business enterprise program is a conscious effort to ensure that some portion of the potential harvest will continue to be available for operators without a secure timber supply.

Even with tenures that convey rights to harvest specified timber volumes, operators generally require a further security to allow efficient development of the timber resource. Planning and investment in roads and other infrastructure must span a number of years to extract the timber from a particular geographic area. In most cases, the operator advances the funds at this stage and then recoups the costs over time. To enable this to work effectively, operating areas are delineated within which a licensee will have access to about 20 years of timber, This does not give permanent rights to an area but effectively distributes operations to reduce conflicts.

The tree farm licence, the woodlot licence and the grazing lease provide the most security. Under these tenures, the operation has evergreen rights to an area and to any productivity gains that result from wise management. The resulting proprietorship is intended to encourage a better level of management and more concern for long-term production.

FAIR PRICE FOR CROWN RESOURCES

The Ministry of Forests is responsible for obtaining a fair price in return for rights to use Crown resources. In order to do this, various schedules and formulas have been devised to establish what the appropriate rates should be. These are discussed elsewhere in this section.

Obtaining a fair price entails not only deriving fair revenues for the Crown but also treating all operators equitably. This requires systems that reduce the advantages and disadvantages between operating areas and equalize opportunities as far as possible in terms of potential profitability. Minimum charges are set below which the Crown is unwilling to dispose of resources.

EFFICIENT DEVELOPMENT OF MANAGEMENT UNITS

This goal is particularly relevant to the timber resource where a transportation infrastructure must be established throughout extensive areas of hinterland. The required road network is expensive to build and maintain and therefore demands optimal location and appropriate construction standards in relation to the timber supplies. This choice must take into account future as well as present needs.

Much of the province's present development pattern resulted from progressive expansion radiating out from manufacturing centres. Greater distances and lower-valued timber now make roads a critical part of long-range planning. Further, the constraints of more intensive integrated management also influence how and where transportation corridors are located.

Operational roads are built by operators and paid for as reductions in stumpage payable on timber from that area. Major roads, serving large tributary areas, are included under policies related to Section 88 of the Forest Act whereby they can be amortized over a greater timber volume than would occur under a stumpage appraisal. With the inception of the small business enterprise program, the ministry has extended its direct role in road building to provide access.

To help achieve the most efficient development of management units, more consideration is currently being given to issuing tree farm licences. Under this area-specific tenure, the licensee is given more incentive to develop and manage timber with future needs in mind.

HARVESTING PRACTICES

Much of the Ministry of Forests' operational activities are devoted to approving and monitoring harvesting and forest management practices. Under most tenures, the industry is required to develop plans which are then subject to Ministry of Forests' review and approval. The process involves consultation with other resource agencies for advice about program interactions. Typical management prescriptions include multiple pass harvesting systems, leave strips, size of opening, deferment of areas of special interest, green-up provisions and minimum regeneration targets, among other things. Silvicultural systems must include acceptable means for harvesting the timber and for reforesting the site. The government cannot currently control the quality of forestry practices on private lands except those under some form of management agreement.

USER PARTICIPATION

Within the limits of policies that prescribe how forest and range lands will be managed, the Ministry of Forests attempts to attain the maximum level of flexibility in management decisions in order to incorporate public and industry interests. Decentralizing decision making within the ministry is an attempt to facilitate closer contact with the users and the resources. Other mechanisms include timber supply area committees and the public participation processes. Provisions for delegating further responsibilities to the forest industry will bring its participation in management to an even higher level than at present.

While the goal of user participation is to achieve the optimum use of resources, often all demands cannot be satisfied. This means that trade-offs are required and, to varying degrees, some interests will be only partially fulfilled. In some instances, the desires of local users must be balanced against a broader provincial interest. There are no easy solutions to most of these allocation problems and the topic continues to be a contentious one in forest management.

CHAPTER E2

RESOURCE ADMINISTRATION

This chapter describes the various agreements through which the Ministry of Forests exerts control over the management of timber and range resources on both private and Crown land.

TIMBER ADMINISTRATION ON PRIVATE LANDS

Private lands are those that have their deeds vested in an individual or group of individuals other than the Crown. They include lands granted by the Crown in aid of railways or other public works, lands sold, and lands homesteaded or preempted.

The province exerts minimal controls (for example, fire, insect and disease controls) over timber harvesting or silviculture on private land. Other matters are left to the discretion of the land owner. Though numerous controversies have arisen regarding visual or environmental impacts resulting from owners altering forest cover, to date the government has not intervened. Taxation influences management quality to some extent as, for example, in tree farms.

TREE FARMS

Some private lands may be classified as tree farms to encourage good forest management through reduced taxes.

To be classified as a tree farm, privately owned land must have its best economic use under forest crop and must be either adequately stocked or subject to an approved regeneration plan. Mature timber harvest must be on a sustained yield basis and in accordance with an approved plan.

Any land owner may apply to have his land classified as tree farm land. The application must contain a complete description of the area including the basic land and forest cover data and a detailed plan of forest management which contains short (five-year) and long-term harvest projections.

Owners of tree farm land are required to submit annual reports detailing achievements in reforestation, silviculture, protection and harvesting. Lack of adherence to the working plan may result in the loss of the tree farm classification.

Tree farm land is valued only on the present worth of the income from present and future predicted harvests. The land itself is not valued at all; improvements (buildings, roads, etc.) are assessed separately. The land is subject to general, school and other taxes applied against a percentage of the value.

INDIAN RESERVE LAND

Lands contained in Indian Reserves were transferred by the province to the federal government to be held in trust for the benefit and use of Indian Bands. Land, timber and other rights to resources may be secured only in accordance with provisions under the Indian Act. The Department of Indian and Northern Affairs is the agency through which rights to harvest timber may be acquired. Rights to harvest and sell timber may be granted directly to Indians under a permit system or, with the consent of the band members, to other persons through a form of timber sale or timber licence. Provincial royalty is not payable but the federal government charges stumpage. Export of the timber in an unmanufactured state is not restricted by provincial statutes.

Under the provisions of Tree Farm Licence #42 awarded to the Tanizul Indian Band in 1983, forested lands owned by the band will be managed along with additional Crown lands as a sustained yield unit. This agreement will bring forest management on the whole TFL in line with provincial standards.

TIMBER ADMINISTRATION ON CROWN LAND

The land and timber described on provincial Crown land remain in Crown ownership. However, there are various forms of tenure, both on an area and volume basis, that may be granted to licensees in order to manage the forest and range resources on that land.

THE TREE FARM LICENCE

The tree farm licence form of tenure was authorized under the Forest Act of 1947. Forty-one tree farm licences were awarded between 1948 and 1966 but several of them have been amalgamated, reducing the number to 34.

In 1982, the Forest Act was amended to enable licensees to replace one or more forest licences and timber sale licences with a tree farm licence. To acquire a tree farm licence, the applicant must submit a proposal to the Minister of Forests. The proposal is subjected to a public hearing which assures public awareness of the proposal and provides an opportunity for all interested parties to make their concerns known. In the case of new applications, unrelated to previous tenures, the hearing process also enables competing proposals to be submitted for evaluation.

Term

Each licence has a term of 25 years, but at 10-year intervals, 25-year replacement licences are offered for the same area. This evergreen provision also enables the conditions of the licence to be revised. If the licensee does not accept the revised terms, the agreement will continue for its remaining 15 years, at which time it will terminate with no further replacement rights.

The Crown can also terminate the replacement process by including a clause to that effect in a replacement licence. That gives the holder a 25-year notice of termination.

Purpose

Tree farm licences are designed to provide the licence holder with a secure timber supply, generally considered essential for obtaining the major funding investments needed for better management and more efficient processing plants. They are also designed to ensure that lands best suited for forest management are used continuously to grow successive tree crops and that they are managed to generate optimum benefits from timber and other forest values. They do this by providing rights to harvest the future allowable annual cut from the successive timber crops on the tree farm licence lands, which provides the holder with an incentive to enhance the land's timber growth and productivity, thereby increasing the flow of benefits to the company and to the province.

Lands Included

In determining what lands are to be included in the tree farm licence, the Minister of Forests considers submissions received at the public hearing and the implications for surrounding lands and for other natural resources. Because the uses of timbered and nontimbered lands are inevitably interlocked, resource management is usually enhanced when they are developed within a single administrative unit bounded by a height of land. Thus, all the land (timbered, nontimbered, alpine and barren) in the drainage are included in the tree farm licence unless other ownerships have to be considered.

A licensee may contribute to the tree farm licence Crown lands held under old timber licences and privately owned lands. These are contained in a separate schedule (Schedule A) from the lands contributed by the Crown (contained in Schedule B). They become subject to the management requirements but retain their ownership and tenure status.

Rights and Responsibilities

A tree farm licence is an area-based tenure. It grants rights to manage the timber resources according to management and working plans approved by the Chief Forester. It also grants rights to obtain cutting permits to harvest the allowable annual cut. In return, the licensee must fulfill certain obligations as follows:

Management and Working Plan. The licence holder must submit management and working plans, normally every five years, to the Chief Forester for approval. These plans must contain the technical forestry data and calculations needed by the Chief Forester to determine the allowable annual cut. They must also contain proposals for:

- protecting the timber from fire and insect damage,
- reforestation and silviculture,
- sequential harvesting,
- public recreational use, and
- integrating forest management with other resource values.

Development Plans. The licensee must submit a five-year development plan detailing timber harvesting operations. This plan is updated annually or as required by the regional manager and contain projections for the ensuing five years.

Harvesting Rates and Cut Control. The licensee must harvest the allowable annual cut approved in the management and working plan, within certain tolerances. Specifically, in each calendar year, the volumes harvested must be within 50% to 150% of the allowable annual cut, and in each 5 year cut control period they must be within 90% to 110% of the sum of the allowable annual cuts for that period.

Monetary penalties are imposed for noncompliance.

Cutting Permits. The licensee must obtain cutting permits to harvest any timber from the lands in the licence. The licence application for a cutting permit must provide all the site specific information about the timber and topographic conditions of the cutting permit areas. This information is used to determine the content of the cutting permit and to set the stumpage rates.

Logging Contracting. Under old tree farm licences, the licensee is required to have not less than 50% of the annual allowable harvest on Schedule B Crown lands logged by logging contractors each year. (For example, if the Schedule B Crown lands account for 88% of the allowable annual cut of the tree farm licence, not less than 44% of the total volume harvested under the tree farm licence must be harvested by contract loggers.)

New tree farm licences may fix the percentage at 50% or higher; the contracted volume may come from any of the lands in the tree farm licence; and the minimum volume requirement will increase or decrease each year as the total volume harvested from the tree farm licence increases or decreases.

Effects of a Tree Farm Licence on Surrounding Lands

The implications of a tree farm licence for the surrounding lands are generally assessed when the licence application or its management and working plan is considered. Every effort is made to minimize the risks of conflicts with the uses of adjacent lands. This is done partly by using natural boundaries wherever possible to define the licence area.

Other Uses of Lands Under Tree Farm Licence

The Forest Act asserts that no agreement made under the Act prevents the Crown from using or authorizing the use of the Crown land for any purpose compatible with timber harvesting. It is important to note that the tree farm licence does not grant any nontimber rights to the licensee. Such rights can only be granted by the appropriate agency or ministry of the Crown.

Exclusions of Land from Tree Farm Licences

Because a tree farm licence is contractual, any land may be excluded at any time provided the Crown and the licensee consent. In addition, the Forest Act allows the Minister of Forests to exclude land unilaterally for any purpose other than timber production by giving one year's notice to the licensee. This would normally be done only if the land is needed for public purposes or for a higher social or economic use than forest production.

Depending on circumstances, the tree farm licence holder might be permitted to harvest the timber on the land before it is excluded from the licence; compensation becomes payable if the exclusion exceeds 5% of the allowable annual cut during the deletion period. (Each consecutive 25-year period constitutes a new deletion period regardless of replacement at 10-year intervals.)

Timber Sales to Other Parties

A tree farm licence holder is generally accorded exclusive timber harvesting rights, but under the following circumstances, timber from a tree farm licence may be sold by the Crown to other parties:

- when a tree farm licence agreement makes provision for sales of certain quantities of timber to other parties;
- when the licensee fails to remove windthrown or damaged timber;
- when the licensee fails to harvest the required minimum volume (i.e. 90% of the five-year allowable cut).

For any new tree farm licences, the Crown will be able to grant timber sale licences to other parties when the licensee fails to harvest the minimum annual cut requirement (i.e. any volume under 50% of the allowable annual cut).

Crown Charges

Licensees are subject to a variety of charges for timber rights and timber harvested. The most important of these is stumpage, which is levied against timber cut from Schedule B Crown lands. The rates are determined for each cutting permit according to standard appraisal procedures.

Timber royalties are payable on timber cut from Schedule A Crown lands. The rates are set out in the Forest Act. As present old growth is removed from these lands, they are eliminated from Schedule A and added to Schedule B, making stumpage payable on future timber crops.

No stumpage or royalty is payable for timber cut from privately owned lands.

An annual rent of $0.45 per m³ of the allowable annual cut attributable to the Schedule B Crown lands is payable independently of the timber volume harvested. In addition, a rent of $1.25 per hectare is payable on any Crown lands listed in Schedule A.

Stumpage Credits under Section 88

Section 88 of the Forest Act provides for the reimbursement of certain approved forestry expenditures through direct credits against stumpage.

To receive stumpage credits, the licensee submits a proposal to the Ministry outlining the forestry work to be undertaken. If all or part of the proposed work is approved for credits, the amount is agreed upon and a signed addendum is attached to the licence. As various stages of the work are completed, the licensee submits cost claims. Upon approval, the amounts are applied to the appropriate stumpage accounts. If the licensee does not owe any stumpage against which the credits can be applied, the credits are recorded for application against future eligible stumpage. In this event, a very relevant question to be addressed is the magnitude of credit build-up for a given licensee.

Public Access

The general public has unimpeded foot access across all Crown land in a tree farm licence but may not obstruct or interfere with the forestry operations. The public does not have unimpeded access to privately owned land in the tree farm licence.

Subject to industrial safety considerations and road use restrictions and regulations, the public may use any logging roads on Crown lands for noncommercial and nonindustrial purposes. Industrial users may be required to obtain permits from the Forest Service or from the tree farm licensee but legitimate use cannot be refused. Industrial and commercial users may be expected to share some of the road construction and maintenance costs.

In general, where a road crosses private land, the land owner may control its use. Where a Forest Service Road passes through private land, the Crown normally will have obtained right-of-way, and any industrial use will, thus, be subject to Forest Service control or authorization.

THE FOREST LICENCE

The forest licence form of tenure was initiated in the 1978 Forest Act to replace the former timber sale harvesting licence. It is presently the predominant timber licencing tenure in the Province, comprising 61% of the total allowable annual cut from all timber supply areas. This tenure was used to consolidate under one licence all the operations of a licensee in a timber supply area.

Terms

Each licence has a term of 15 years (maximum 20 years in exceptional cases), but every 5 years a 15-year replacement licence is offered covering the same allowable annual cut as approved in the licence being replaced. This ever-green provision allows an opportunity to revise and modify the conditions every 5 years. If the licensee does not accept the revised terms, the agreement will continue for its remaining term whereupon it terminates with no further replacement rights. The replacement process can be terminated by the Crown by including a clause to that effect in a replacement licence offered. That gives the holder a 10-year notice of termination (15 in exceptional cases).

Rights and Responsibilities

A forest licence is a volume agreement. It grants rights to obtain cutting permits from time to time to harvest the allowable annual cut specified in the licence in accordance with the approved management and working plans. In return, the licensee has the following obligations:

Management and Working Plan. The licensee must submit successive 5-year management and working plans prepared by a registered professional forester for approval by the regional manager. Those plans do not include the technical data and allowable annual cut calculations contained in tree farm licence plans but are otherwise similar. They include a description of the operations to be conducted and the silviculture treatments to be undertaken. The licensee is expected to practice basic silviculture to ensure that the crop is replaced and that regeneration attains a free-growing status within a specified period.

Development Plans. Five-year development plans are required for tree farm licences and must be updated annually or as required by the regional manager.

Harvesting Rates and Cut Control. The cut control requirements are the same as those described for the tree farm licence, except that the allowable annual cut to which they relate is specified in the licence rather than in the management and working plans.

Cutting Permits. The licensee must obtain cutting permits for harvesting any timber from any lands in the licence. The licensee submits applications for the cutting permits and provides all the site-specific information about the timber and topographic conditions needed to determine the content of the cutting permits and to set the stumpage rates.

Logging Contracting. The regional manager may stipulate what portion of the volume harvested must be contracted. As long as the historic contracting pattern continues, this provision will not likely be invoked.

Developmental Area (chart area)

The area in which timber harvesting operations will be carried out is chosen by the licensee and approved by the district manager. The selection process normally involves discussions with other licensees and affected parties, with unresolved conflicts adjudicated by the regional manager. The area chosen is commonly called a chart area.

Other Uses of Lands (in the chart area)

The Crown retains full rights to authorize other uses of Crown lands in the chart area.

Allowable Annual Cut Adjustments

The Forest Act enables the allowable annual cut of a forest licence to be adjusted for certain reasons.

1. When a licensee increases the land's timber productivity by applying higher timber utilization standards or more silvicultural treatments than the licence requires, the regional manager may approve an increase in the allowable annual cut. In a similar manner, the allowable annual cut may be reduced when the licensee causes the land's timber productivity to fall, or where the licensee fails to harvest the minimum required volume.

2. If the allowable annual cut of the timber supply area is reduced for any reason other than land exclusions, for example, a major fire loss or insect infestation, the Minister may proportionately reduce the allowable annual cuts of all forest licences in the timber supply area.

3. The Minister of Forests may reduce the allowable annual cut of a forest licence where Crown land in the timber supply area is to be used for rights-of-way, water storage or other nontimber production purposes.

Crown Charges

Stumpage is payable on all timber harvested, as calculated by standard stumpage appraisal procedures.

An annual rent is also payable as set out in the Forest Act. It is currently \$0.25 per m^3 of the allowable annual cut.

Stumpage Credits under Section 88

Section 88 stumpage credits can be applied under forest licences on the same basis as for other stumpage bearing licences. The purpose and process is the same as for tree farm licences.

Forest Roads

A forest licence does not authorize the construction of logging roads except within the cutting permit areas. Separate authorization is required in the form of Road Permits or through addenda to agreements. The road locations and standards will generally form part of the development plan.

Roads constructed at the licensee's expense are deemed to be owned by the licensee. Roads constructed under stumpage credits automatically become Forest Service Roads.

THE TIMBER SALE LICENCE

Timber sale licences have been used to dispose of Crown timber ever since the original Forest Act of 1912. They are sufficiently flexible to be used under a wide variety of circumstances to meet various needs. The 1978 Forest Act specifies in more detail than the previous Act the nature and content of the timber sale licence, but a large measure of flexibility is still provided.

Three forms of Timber Sale Licences are in use.

1. The timber sale licence (Major) is a volume agreement containing essentially all the conditions and requirements of a forest licence agreement. It is used for timber disposal in response to a request by an applicant who has a timber quota in a timber supply area but the quantity is not sufficient to warrant issuance of a forest licence tenure. The term is typically the 10 years maximum and the agreement is subject to replacement in its final year. This agreement may also be adapted for salvaging timber or handling special cases where a volume agreement is chosen without replacement rights. These timber sale licences (Major) comprise in total only 1.2% of the allowable annual cut.

2. The timber sale licence (Minor) is an area-based agreement. It is used whenever applications and competitive bids are restricted to small business enterprises. It may also be used when a specific tract or parcel of timber is to be cleared or when timber is to be salvaged before flooding. It does not specify an annual allowable cut or annual rate of harvest.

A timber sale licence contains all the normal provisions relating to timber utilization standards, slash disposal and fire hazard abatement and prevention of stream pollution and environmental damage. It does not contain reforestation or road construction requirements.

Some 500 to 600 of these short term licences are issued each year and there are about 1200 currently in force. They account for about 7% of the total volume of timber harvested.

3. The cash timber sale licence is a short form agreement for lump sum sales of minor quantities of Crown timber.

THE TIMBER LICENCE

The timber licence was devised to replace five types of old temporary tenures. Those tenures were originally granted before 1907 with the agreement that as long as the annual fees were paid they would be renewed until the original merchantable timber has been harvested. The timber licence honours that historic commitment.

Many of those old temporary tenures were logged or allowed to expire, but in 1978 some 2500 were still in existence, most of them held by a few major companies. Some 1400 of them were contained in tree farm licence Schedule A lands. The 1978 Forest Act enabled them to be amalgamated into a smaller number of new timber licences for more efficient administration. Blocks of adjacent temporary tenures or those in a general operational area, and held by one licensee, were consolidated into single replacement timber licences. Each licence has a finite term long enough to allow the original timber crop to be harvested.

Some timber licences are still contained in tree farm licences. They are subject to the tree farm licence agreement and its management and working plan, and their expiry dates have been made consistent with those of the tree farm licence. When the original timber of those timber licences has been harvested, the lands are to be transferred from Schedule A to Schedule B lands and, thus, will remain in the tree farm licence.

The holders of old temporary tenures not contained in a tree farm licence were required under the new Forest Act to submit a schedule for harvesting the original timber crops. The schedule provided a basis for determining the term for each of the replacement timber licences. All timber harvesting operations on these timber licences must be carried out under cutting permits that conform with approved operating plans prepared by professional foresters as submitted by the licensee.

Holders of any old temporary tenures, whether inside or outside a tree farm licence, were given the option under the 1978 Forest Act to choose prior to 1981 to either continue to pay timber royalties along with reforestation and other costs, or to pay stumpage. Except for two timber licences in the interior, all other tenure holders chose to pay royalties.

THE PULPWOOD AGREEMENT

The pulpwood agreement tenure is designed to encourage the establishment, expansion or continuance of woodfibre processing plants to utilize the wood residues from harvesting and processing timber. It provides a back-up supply of roundwood in the form of standing timber to cover any temporary disruption in the supply of wood residues normally available as raw material for the woodfibre processing plant.

Pulpwood agreements will replace the 5 existing pulpwood harvesting area agreements when they expire, and new pulpwood agreements can be issued. The latter requires advertising for proposals, a public hearing, evaluation of the proposals and submissions, and approval by the Lieutenant Governor-in-Council.

The holder of the agreement undertakes to use the wood residues from his own operations and to purchase suitable residues from others. But if those sources are disrupted, and all other feasible means of obtaining wood residues have been exhausted, timber sale licences can be acquired to bridge the gap and sustain operation of the plant at a reasonable level.

A pulpwood agreement has a term of 25 years with "evergreen" replacement provisions at 10 year intervals, similar to a tree farm licence.

THE WOODLOT LICENCE

The woodlot licence tenure is designed to accommodate the dual purpose of providing an acceptable high level of forest management on small isolated parcels of Crown forest land and of promoting small scale forestry on other private lands held by the licensee. It is being used to replace the 36 farm woodlot licences as they expire, and it is intended to function like a miniature tree farm licence, but with less onerous terms and conditions.

A woodlot licence has a maximum term of 15 years but "evergreen" replacements are available at 5 year intervals similar to a forest licence. The area covered may not exceed 400 ha of Crown land. There are no restrictions on the area of private land covered.

The timber resource must be managed under an approved management and working plan for the licence area and any timber harvesting must be carried out under cutting permits issued in conformity with the plan.

MISCELLANEOUS PERMIT AGREEMENTS

Cutting Permits

Cutting permits authorize the harvesting of timber under various licences from specific areas and contain specific provisions relating to timber utilization specifications, silvicultural treatments, stumpage or royalty payments, timber marks, timber scaling, logging practices, waste and damage assessments, slash disposal and any special provisions.

They normally cover a short term not exceeding three years.

Free Use Permits

A free use permit authorizes its holder to harvest specific quantities of timber from a specific area of Crown Land without paying any stumpage or royalty. Such permits are restricted to developing land for agricultural purposes; domestic firewood needs; school board firewood needs; scientific investigations; mineral claim development and operation; coal licence or placer lease development; exploration and development of minerals or coal; for stulls and props for underground mining operations; or for construction of related buildings.

Free use permits have a short term and contain provisions covering forest practice requirements.

Road Permits

Road permits authorize the holder to construct or modify and use a road on Crown land, or to use a Forest Service Road in order to gain access to timber on Crown or private land.

In addition to specifying the location and standards for construction, it contains provisions, where applicable, relating to the clearing of, and harvesting timber on, the road right-of-way.

Christmas Tree Permits

A Christmas tree permit authorizes the permit holder to harvest or grow and harvest Christmas trees on Crown land. It contains provisions designed for those purposes.

Licence to Cut

A licence to cut authorizes a person to remove timber from Crown land to allow the use of land for some other authorized purpose. It is also used to authorize timber harvesting from certain privately owned land on which timber is owned by the Crown.

The licence to cut includes provisions relating to the harvesting, utilization and disposal of the timber and the payments due.

The Licence to Cut agreement includes provisions relating to the harvesting, utilization and disposal of the timber and the payments due.

Receiving Station Licence

A receiving station licence authorizes its holder to accept salvaged logs within a log salvage district.

This licence forms part of the procedures for administering the recovery and disposition of stray logs.

Log Salvage Permit

A log salvage permit is required for the salvaging of stray logs in a log salvage district. The annual fee for this permit is $100.

RANGE ADMINISTRATION ON PRIVATE AND CROWN LANDS

GRAZING TENURES

The Ministry of Forests' Range Management Branch is responsible for administering several range resource tenures on Crown land including grazing permits, grazing licences, hay cutting permits and hay cutting licences. In addition, it administers and manages grazing leases jointly with the Ministry of Lands, Parks and Housing.

The primary purpose of grazing tenures is to legitimize the use of Crown range resources by farmers and ranchers, and to offer to the range tenure holder some security regarding short-term and long-term use of Crown range resources.

The Ministry of Forests, in a few cases, has management control over private range through Private Land Agreements. These agreements are generally issued when livestock has been trespassing on Crown range. The agreement permits the trespass in exchange for Ministry of Forests' management over the private land.

RANGE TENURES UNDER THE RANGE ACT

At the present time, the two principal tenures used for allocating grazing rights to farmers and ranchers are grazing permits and grazing licences. These are intended to provide the necessary stability for ranching operations and the opportunity for ranches with a sufficient forage base to manage livestock on a year-round basis.

A grazing permit may be issued for a period of up to five years. It is renewable unless the land is required for a higher use or the area has been inappropriately managed. The Ministry of Forests is currently converting grazing permits to licences where this is considered to be in the best interests of the ranching community and the long-term utilization of the range resource.

A grazing licence may be issued for a period of up to ten years with a renewal option after the seventh year. The tenure holder must prepare a management plan for the Ministry of Forests' approval.

The fee structure is the same for grazing licences and permits and is based on how many animal units per month the land will support. The fee has two parts: a forage fee and a ground rent. The forage fee is indexed to the average price per kilogram of all livestock sold through B.C. Livestock Cooperative Association sales yards. The ground rent of $0.20 per AUM is added to this fee.

Before being issued a grazing tenure, a rancher must establish to the satisfaction of Range Management Branch that his base ranch can produce enough forage to sustain the livestock when they are not grazing on Crown range. That is, the base ranch must be what is called 'commensurable'. In certain areas under special circumstances, the commensurability condition may be waived, but in most range areas it is the primary consideration used to decide whether a grazing tenure will be issued. Such factors as proximity to the range area, overall need of the applicant and whether the additional grazing rights will contribute to the viability of the ranching operation are also considered. Finally, because the Ministry of Forests is responsible for managing range for both livestock and wildlife, it must also consider the needs and requirements of wildlife resources.

The Range Act provides for the orderly transfer of range rights when ranching operations are sold. When range rights are transferred to nonaffiliated corporations or companies and unrelated individuals, the Minister's consent is required. But when a range right is transferred between family members or affiliated corporations, the Minister of Forests' approval is not required.

When an area is to be deleted from a range tenure, the Range Act (Sections 22 to 26) provides for compensation when the reduction is greater than 5% of the authorized use. The compensation need not be paid when a suitable range area can be found to replace the deleted area.

Two tenures are designed to provide farmers and ranchers with forage resources for winter feeding: a hay cutting permit and a hay cutting licence. A hay cutting permit may be issued for one year; a hay cutting licence may be issued for ten years. The fees charged for both hay cutting permits and licences are three times the forage fee for each metric tonne, plus $0.60 per metric tonne ground rent.

While the number of hay cutting tenures is relatively small, as is the revenue they produce, they are of considerable value to the rancher holding them.

RANGE TENURES UNDER THE LAND ACT

The Ministry of Forests is responsible for administering and managing grazing leases issued by the Ministry of Lands, Parks and Housing. Approximately 1,500 grazing leases covering some 250,000 hectares have been issued. Before re-issuing a grazing lease, the rancher, in cooperation with the Ministry of Forests, must prepare a management plan which is submitted to the Ministry of Lands, Parks and Housing for inclusion in the grazing lease document. Once the lease is issued the Range Management Branch is responsible for managing the range resource on it. This joint administration and management is the subject of a protocol agreement between the two ministries.

CHAPTER E3

MANAGEMENT OF PRIVATE FOREST LANDS

One of the functions of the Ministry of Forests is to encourage the maximum productivity of the forest and range resources of the province. While most of the emphasis is placed on Crown land, there are a number of programs which are designed to encourage private owners to sustain the timber production from their land. A private land owner is usually interested in maximizing those products which will produce the highest economic return to him and may not include the realization of broader social interests in fisheries, water, wildlife and recreational benefits. Programs relating to private land are designed to try to take into account both the Crown's and owner's objectives.

Concern for the level of forest management on private forest land was addressed in the 1945 report of the Commissioner on the Forest Resources of British Columbia. To achieve a level of planned and regulated forest management leading to sustained yield, the Commissioner recommended that "taxation should be formulated to encourage private forestry and to remove causes compelling liquidation". The Taxation Act was amended in 1951 "to encourage the practice of sustained tree crop production on privately owned forest land with the new classification of tree farm land". These amendments were incorporated into the Assessment Act.

Management of private forest land can be broken into 3 main categories:

1. managed as an integral part of a tree farm licence (TFL) or woodlot licence (WL) under the Forest Act;
2. managed as a tree farm under the Assessment Act; and
3. not managed under a tenure agreement with the ministry.

Within the first category the Forest Act makes provision for private forest land to be combined with Crown lands within units such as TFLs and WLs to create a more viable operation.

Under the Assessment Act, the tree farm land classification makes provision for private forest land, which is managed for sustained yield under an approved working plan, to be subject to a lower assessed value for taxation purposes. Ministry policy requires that subsequent to an application to the B.C. Assessment Authority for classification of land as tree farm land, the application (including a working plan designed to maintain the land in a state of continuous productivity) must be referred to the Ministry of Forests for approval by the Chief Forester. When the plan is approved and the assessor has confirmed that the land meets the definition of tree farm land under the Assessment Act, the ministry prepares a Certificate of Tree Farm Land for the Minister's signature.

An Annual Return must be produced to ensure that the land is managed in accordance with the approved working plan. A Certificate of Tree Farm Land may be cancelled by the Minister of Forests if the plan is not being followed.

In 1956 there were 15 tree farms comprising 103,708 hectares of land with a total allowable annual cut of 204,156 m^3. Since then, the program has grown to a total of 52 tree farms comprising 759,884 hectares of land with a total allowable annual cut of 4,429,187 m^3. Sixteen tree farms form an integral part of tree farm licences issued under Part 3 of the Forest Act.

Table E-1. Tree Farm Statistics

	Number of Tree Farms	Productive Area	AAC (m^3)	Christmas Trees (#/yr.)
Within TFL	16	171,576	896,937	0
Not in a TFL	36	588,308	3,532,241	297,590
TOTAL	52	759,884	4,429,178	297,590

*Data in this table are as of January 1, 1984.

SIGNIFICANCE OF TREE FARMS WITHIN A TFL

Tree farms which are managed as an integral part of TFLs account for 2.3% of the productive forest land and 4.6% of the total allowable annual cut under this form of tenure. From an administrative point of view, tree farms within TFLs are not that significant as all of the land is managed in accordance with an approved management and working plan.

There are also cases of private lands within TFLs which are not classed as tree farms. These lands are also managed as an integral part of the TFL.

SIGNIFICANCE OF TREE FARMS NOT WITHIN A TFL

Tree farms which are not an integral part of a TFL have a total allowable annual cut which is equal to 5% of the allowable annual cut approved for all timber supply areas. In addition, they have a total productive area which is equal to 1% of the productive land in all TSAs. In comparison to total productive land in the TSAs in the Vancouver and Nelson Forest Regions, the productive lands in these tree farms is equal to 9% and 5% respectively. Similarly, as a percent of the total Crown AAC (excluding the TFL portion) within the TSAs in the Vancouver and Nelson Forest Regions, the allowable annual cut for these tree farms is equal to 15% and 6% respectively. Tree farms are generally located close to communities and therefore may have a significant effect on the supply of economically attractive timber.

As noted in the foregoing, not all Crown granted forest lands are formally managed under the Forest Act or the Assessment Act. These lands may or may not be managed under good forest management principles. The extent of these lands is not fully known and further analysis is required to assess and determine their full potential.

TRENDS

Although there has been a significant increase in the number of tree farms since the implementation of the program, there is still a substantial area of private forest land outside the program. It is suspected that the reasons for the lack of participation by more owners are:

1. there are a large number of small holdings for which the cost of producing the working plan and annual returns offset any economic advantage that the tree farm classification may confer on the owners;
2. owners are reluctant to have to deal with government bureaucracy;
3. owners of private forest land may have objectives (such as land speculation) which do not meet the Crown's objective;
4. owners may not have the technical knowledge required; and
5. the owners may not gain a tax advantage by assuming tree farm status due to the age and condition of the growing stock.

It is expected that there may be an increase in the number of tree farms as a result of the Woodlot Licence Program which allows owners of small parcels of forest land to manage their own lands in conjuction with up to 400 hectares of Crown land.

There are about 210,400 hectares of land outside of management agreements which are classified as productive forest land for taxation purposes. The provincial forest inventory data base indicates that there is an additional area of some 650,000 hectares of private land which may have potential for timber production, thereby increasing the total area which could be producing timber to about 1.6 million hectares. Currently, the full potential of this land area is not being utilized. Approximtely 56% of the 210,000 hectares represent good growing sites, and therefore may be a missed opportunity to capitalize on increasing the production of the available timber supply. These areas number in excess of 3,000 and are generally less than 100 hectares each. The ministry does recognize, however, that some areas under wholly private management are already being managed in a very efficient manner.

CHAPTER E4

EVALUATION OF THE MINISTRY OF FORESTS' PROGRAMS

The functions and activities of the Ministry of Forests are organized into nine programs, in addition to the Minister's office which is included as a tenth program for budgetting purposes. These were originally used to describe the divisions within the Five-Year Program but have since become accepted for use within the overall management system. However, in the Five-Year Program, 'program' is defined very narrowly to mean the objectives to be funded under successive annual budgets. For the Resource Analysis, it is defined more broadly to include the full range of policies, procedures, activities and other functions the ministry undertakes within a specific area of responsibility.

In the 1979 Resource Analysis, program descriptions were based on branch responsibilities, which was consistent with the budgeting procedures in place at that time. The ministry continues to discharge its responsibilities through a branch structure but that structure does not parallel the new program divisions. However, the relationships are readily apparent as indicated in the following overviews of the nine internal programs.

Detailed discussions of each program are found later in this chapter.

OVERVIEW OF MINISTRY OF FORESTS PROGRAMS

MANAGEMENT PROGRAM

The Management Program provides executive direction and control for the whole ministry, and spans all three organizational levels. At headquarters in Victoria, it includes the activities and expenditure of the Executive of the Ministry, Information Services Branch and Strategic Studies Branch. At the regional level, it includes the regional manager and regional staff managers; and at the district level, it includes the district managers, operations superintendents and support services supervisors.

Wages and salaries account for about 85% of all expenditures in this program. Materials, expenses and supplies account for the remaining 15%. As a proportion of the total expenditure forecast for the ministry, this program accounts for about 4%.

FINANCE AND ADMINISTRATION PROGRAM

The Finance and Administration Program provides the basic infrastructure for the whole ministry including buildings and financial, administrative, personnel, computer systems and mechanical services.

At headquarters in Victoria, the program includes the activities and expenditures of Financial Services, Personnel Services, System Services, and Technical and Administrative Services Branches. At the regional level, it includes administrative, personnel, training and technical support officers; and at the district level, it includes clerical, drafting and service technicians.

The major expenditures are for wages and salaries as well as buildings, grounds and offices, which the ministry rents from the British Columbia Buildings Corporation. Payments to the corporation account for about 35% of total expenditures. Wages and salaries make up an additional 40%. As a proportion of the total ministry expenditure, this program accounts for about 20%.

RESEARCH PROGRAM

The Research Program supports the forest and range resource management programs by providing knowledge and methods for achieving objectives, based on scientific investigation. It includes the activities of the Research Branch at headquarters and research officers at the regional level. Three percent of the ministry's expenditures are directed to research.

RANGE MANAGEMENT PROGRAM

The Range Management Program makes forage available for domestic animals, while conserving the resource base so that future forage production will continue in a manner consistent with multiple-use objectives for Crown land.

The program includes the activities and expenditures of the Range Management Branch at headquarters, range officers at the regional level, and range resource officers at the district level. It accounts for 2% of ministry expenditures.

RECREATION MANAGEMENT PROGRAM

The Recreation Management Program endeavours to maintain and enhance recreational values and to provide a system of sites and trails to facilitate public recreational use of Crown forest land within the Ministry's multiple-use objectives.

The program includes activities and expenditures of the Recreation Management Branch at headquarters, recreation officers at the regional level and recreation resource officers at the district level. It accounts for 1% of ministry expenditures.

HARVESTING PROGRAM

The Harvesting Program makes timber available to the forest industry in a manner that reflects provincial forest resource objectives and ensures that the financial interests of the Crown are realized.

At Victoria, the program includes the activities and expenditures of Valuation, Timber Management, Engineering and Planning and Inventory Branches. At the regional level, it includes harvest planning and coordination personnel; and at the district level, it includes timber, scaling, engineering and inventory resource officers. The major expenditures in the Harvesting Program are for salaries and for forest management activities paid for through Section 88 of the Forest Act. In total, the program currently amounts to 20% of ministry expenditures although it normally accounts for almost double that figure.

FOREST PROTECTION PROGRAM

The Forest Protection Program protects the provincial forest and range resources from damage by wildfire and pests such as insects and diseases. It includes the activities and expenditures of the Protection Branch at headquarters, protection officers at the regional level, and protection resource officers at the district level. This program currently accounts for 5% of ministry expenditures.

FIRE SUPPRESSION PROGRAM

The Fire Suppression Program provides fire fighting services required for the control of wildfires. It is linked closely to, and supported by, the Forest Protection Program but is managed and funded separately. Actual expenditures vary with the severity of the fire season but the budget is currently estimated at 9% of the ministry total.

SILVICULTURE PROGRAM

The Silviculture Program restocks denuded forest land and improves the value and productivity of the forest resource.

The program includes the activities and expenditure of the Silviculture Branch at headquarters; the silviculture officers at the regional level; silviculture resource officers at the district level; and nurseries and seed orchards located throughout the province.

The major expenditures under this program are for approved silvicultural treatments or activities undertaken by licensees and financed through Section 88; and by contractors who are financed through budgetary allocations. As a proportion of total ministry expenditures, this program now accounts for 32%.

ANALYSIS AND DISCUSSION OF MINISTRY PROGRAMS

In the following detailed discussions, only the programs directly involved with the resources are included. That is, the Minister's Office, Management and Finance and Administration together comprise the overhead of running the ministry and as such are not of direct relevance from the perspective of the Resource Analysis. The purpose here is to highlight the effectiveness of present programs, noting any deficiencies, and to indicate issues and trends that must be accommodated over the next 10 years. Because the Forest Protection and Fire Suppression Programs are so closely related, they are combined in the discussion.

RESEARCH PROGRAM

The Research Program undertakes scientific investigations to improve the forestry knowledge base. It is responsible for supplying the ministry and other government agencies with information and advice on the latest techniques for improving forest and range management. It directs and coordinates the ministry's research throughout the province. This encompasses applied research, technical consulting services, collaboration with the forest industry and operations staff in pilot-scale testing to demonstrate the feasibility of implementing research results, coordination of research programs with other research agencies and administion of research projects. The Research Branch supplies data processing and computing assistance to all research personnel.

Research Objectives and Trends since 1979

The 1979 reorganization of the Ministry of Forests resulted in a new distribution of managerial responsibilities and the regionalization of research. This change was designed to improve communications between the practitioner and the scientist and to foster more rapid incorporation of research results into operational practice.

In the five-year plan drawn up in 1979, the ministry identified the need for research in many areas of resource management. The gaps in scientific knowledge related to basic and intensive silviculture, range management and harvesting were identified and provisions were made to address them through a planned coordinated research effort. As part of the effort to meet this objective, Regional and Provincial Research Advisory Committees were established to facilitate an essential input from operations staff for identifying problems and establishing research priorities. The input from the advisory committees, when combined with information received from other government ministries and a variety of technical working committees, has proven to be an effective means of identifying and ranking research problems. It also promotes better internal research coordination.

In support of the expanding basic silviculture program, additional efforts were placed on regeneration research, on improving nursery stock quality and on vegetation control. Emphasis on training, extension and consulting activities was increased to ensure research results and new information were incorporated in operational practices. This will remain a high priority as the ministry strives to optimize its regeneration activities.

Growth and yield research efforts were intensified to provide improved yield projection capability for timber supply area planning and for determining the allowable annual cut. This is a research area of major concern and requires an expanded and long term commitment.

On advice from industrial participants in the Coastal and Interior Tree Improvement Councils, the tree improvement activities were extended to five commercially valuable tree species. This reflected concerns for improving yields to maintain the wood supply flow on a long-term basis.

In recognition of wood supply shortages and the ministry's emphasis on multi-resource concerns, initiatives were taken to address intensive forestry-integrated resource use problems by establishing multi-agency projects focussed on sensitive wildlife/forestry, fish/forestry and range management issues. This is likely to be a long-term trend: as the importance of integrated resource management becomes more widely recognized, cooperative projects supported by different ministries and institutions will increase.

Although research funds have been cut in real terms over the past four years, the impact was greatest in 1983-84, resulting in less emphasis on intensive silviculture research.

Functions and Initiatives

The Research Program is organized to provide support to the ministry's major operational activities. The description of the program that follows is organized to reflect this focus. The majority of the research effort is silviculture oriented.

Silviculture Research. Silviculture Research is concerned with seed operations, nursery operations, basic silviculture and intensive silviculture. Seed operations research addresses seed harvesting, handling and storage techniques, seed orchard management and tree improvement. The efficiency of using some seed supplies presently in storage has been improved and seed pelleting has been adopted as a means for achieving mechanical sowing of the western red cedar's irregular-shaped seed. The tree improvement research has identified some of the fastest growing provenances to be used for seed collection and is now providing tested, quality scion material for genetically improved orchards. Seed orchard management research has identified methods for controlling flowering that induce early abundant cone production in several major species. Pollen management has been refined, enabling long-term storage of pollen for tree breeding and seed orchard use.

Nursery operations research is designed to improve management practices so that higher quality stock is shipped for planting. In the bareroot nursery, soil and foliar analysis has been adopted operationally to optimize fertilizer schedules. Seedbed density research results have been combined with recently available precision sowing equipment to produce improved quality and uniformity of planting stock. Tests have been established to determine frost hardiness of stock; in this way lifting dates and stock storability can be established. Root-growth-capacity testing has become routine for lodgepole pine and is used to cull stock that will not meet field performance requirements. This technique is also being used on an exploratory basis with other species. Recently, linear programming techniques have been employed to aid in exploring least cost seed-to-established-plantation nursery production options. Each of these initiatives has been a contributing factor in the steadily improving plantation performance record.

Basic silviculture research is focussed on the practices that can be employed to increase the chances for successful regeneration. A major focus has been on examining means to overcome the conditions in the regeneration site that adversely affect seedling establishment and growth. Results to date include the use of prescribed burning, mechanical and chemical treatments, and different nursery stock types, independently or in combination. An ecological classification system has been implemented and a major portion of the forested areas of the province mapped. The maps are being combined with an extensive training program and management interpretation guide which includes recommendations on site preparation, species selection, etc. Work is now underway to examine successional ecosystems in order to provide the basis for future research on, and management of, competing vegetation, one of the biggest problems affecting successful regeneration.

Intensive silviculture research is focussed on the influence that thinning and fertilization treatments have on growth and yield. This has led to the development of tree and stand simulation techniques used to produce interim managed-stand yield tables. This research effort also provides the managed stand background data required by the Planning and Inventory Branch to conduct timber supply yield analyses.

Harvesting Research. Harvesting research addresses issues related to the direct impacts of harvesting on the forest resource and the environmental impact on other resources.

Mass wasting, surface erosion and construction effects can cause site degradation through soil loss or disturbance. Research is underway to assess their impacts and to determine what can be done to prevent degradation and how sites can be rehabilitated after being degraded. Techniques have been developed, demonstrated and implemented for revegetating roadsides to reduce surface erosion. Rehabilitation techniques for landing and skid trails are being tested and have been adopted where appropriate. In areas with steep unstable terrain, mapping procedures have been implemented as part of the operational planning practice.

Virtually every timber supply area requires recognition of resource uses other than timber production. Areas of principal concern are watershed integrity, wildlife habitat and fisheries habitat. At present, critical winter range requirements for mule deer in the interior and elk and blacktail deer on the coast are being studied by joint Ministry of Environment and Ministry of Forests research teams. From this work, demonstrations incorporating harvesting prescriptions designed to optimize timber and wildlife values are being established.

A cooperative program between the Department of Fisheries and Oceans, Canadian Forestry Service, Ministry of Environment and Ministry of Forests is also underway on the Queen Charlotte Islands to provide information about the impact of harvesting on fish habitat and forest sites and to discover ways to reduce impacts or to rehabilitate sites. The trend to research in this area will continue as a ministry priority as resource users continue to demand a greater share of the total resource value.

Forest Protection Research. A primary concern in forest protection research is developing the capability to predict the impact of fire, disease and insects on future wood supplies.

The Canadian Forestry Service undertakes much of the protection research. In keeping with the Memorandum of Understanding signed in 1981, the ministry's regional research and protection staff have worked closely with the Canadian Forest Service in refining plantation survey methodology used to gather data to design operational prescriptions. The Research Branch has also been monitoring the success of various spray and trap tree techniques used to control pests. In the Cariboo Region, it has begun to draw together the information available on lodgepole pine insects and disease and to develop stand management guidelines. And as a result of severe hare and squirrel damage in young managed stands of lodgepole pine, it is examining the influence of second growth management practices on the extent of such damage.

Range Management Research. Though the Ministry of Forests has been responsible for Crown range since the Grazing Act of 1919, it has done little research to supply the information needed for range management. At present, the Research Branch is reviewing range research needs and conducting a detailed problem analysis of key issues. It is also conducting research on the response of range vegetation to fertilization. Research is needed on range condition and trends, the impact of fire on forage production and the carrying capacity of forested ranges to enable managers to make important range management decisions.

Forest Recreation Research. No formal research program is in place at this date for forest recreation research, but during 1980-81, the Research Branch completed a report on MacMillan Park, showing the various ecosystems and their recreational values. These have been used to help managers maintain the integrity of the park and to enhance its recreational potential.

The research needs in this area relate primarily to developing quantitative techniques for assessing user demand on, and recreational values of, forest land. The results of such assessments could then be used in multiple-use planning and analysis.

Issues

The main issues related to the research program are outlined here:

Program Scale. If new research initiatives are to be undertaken, the program will need to be expanded. At present in British Columbia, all research agencies combined annually spend about 0.3% of the gross provincial value of forest products on forestry research. The need for research is especially apparent in growth and yield, forest protection, recreation and range research. Furthermore, to optimize research results, additional facilities and equipment will be needed.

Research Organization. Coordinating the research of different agencies and individuals involved in multi-disciplinary research presents difficult management challenges and as more research of this nature is undertaken, the problems will grow. For maximum program efficiency and effectiveness, all research and development in the Ministry of Forests should come under the direction of a single authority. This would provide the control necessary to ensure that research projects are consistent with identified provincial priorities.

Contract Research. Contract research usually provides practical, feasible solutions to relatively short-term, well-defined projects in which results become available in a relatively short time (up to 5 years). It is a particularly effective way to access expertise not presently on staff. Experience, however, shows that the contract approach in long-term projects such as tree breeding, intensive silvicultural practices, etc., lacks the continuity of personnel critical to successful research. It is, therefore, essential that contracts are used as part of, rather than a replacement for, research capabilities within the Ministry.

Identifying Operational Problems. While serious attempts are made to determine the most cost-effective silvicultural prescriptions from a timber management point of view, there has been little attempt to identity or quantify their impacts on the nontimber values such as recreation, wildlife, water quality, etc.

RANGE MANAGEMENT PROGRAM

The Range Management Program comprises managing and allocating forage for livestock on Crown range under Ministry of Forests' control.

The magnitude and importance of the Crown range resources to the ranching industry is often not appreciated. In 1983-84 fiscal year, 262 grazing licences were issued to 250 operators and 1,847 grazing permits issued to 1,964 operators. In total 994,985 animal units per month (AUMs) were authorized and 937,765 AUMs used. In 1983-84, 7,992 horses, 1,611 sheep and 220,027 cattle, virtually the entire herd, used Crown range.

Under current range management strategies, about 13% of the forage for livestock is obtained from open range. The remaining forage is obtained from land with varying wood-fibre production values. The dry forest provides about 22% of the forage; an additional 20% comes from transitional forests, which include coniferous forest - age class 1. Of the total nonalienated land base of 78.5 million hectares, approximately 8.3 million hectares are managed for livestock forage and a larger area is available for wildlife forage and habitat.

Functions

The Range Management Branch is responsible for range administration, planning, improvement, inventory and monitoring, extension services and research.

Range administration consists of allocating range resources between livestock use and wildlife use, administering grazing and haycutting licences and permits, and administering grazing leases in cooperation with the Ministry of Lands, Parks and Housing.

Range planning consists of:

(1) preparing range unit plans, which include livestock rotations, livestock management and range improvement (subject to multiple-use requirements of the land base) on all range units including community pastures;

(2) conducting preharvest assessments, which includes assessing treatments for forage production and other existing and proposed range improvements;

(3) drawing up Crown range management plans which facilitate multiple use on the Crown land base; and

(4) assisting in timber supply area planning, which integrates range resources and use with wood-fibre production and harvesting and other uses of Crown lands.

Range improvement consists of doing field layouts, and managing and auditing construction and improvements. Range improvements include knapweed and other weed containment; seeding of selected clearcuts; fencing, water developments, trails and related structures; and range burns.

Range inventories and monitoring of range use, production, condition and trends are undertaken to evaluate the efficiency of existing range unit plans and to provide alternatives.

Range research focusses on providing reliable data on the impact of range and other treatments on the range resource. The Range Management Branch and Research Branch work together to review range research needs and to implement range research activities.

Accomplishments and Initiatives

1. In the Prince Rupert Forest Region, the number of tenures grew from 4 issued to 4 operators in 1978 to 194 tenures issued to 190 operators in 1983-84. Throughout the province, the Range Management Branch assumed grazing lease planning and monitoring responsibilities on approximately 1,500 grazing leases.

2. To maintain a comprehensive record of all grazing and haycutting tenures, the branch has instituted a computerized range management system. The data produced provides a basis for range management planning and evaluation. The system is centrally maintained at present but will be decentralized to the district level in the near future. In addition, a computerized range-improvement system, which will include all range improvement information, is now being developed. It will be supported by reports on weed containment and, perhaps, by reports on range seeding and range burning.

   A computerized system to provide range area statistics has also been developed. Once range unit boundaries are digitized, this system could be used to systematically generate range area statistics using the specific or general type classifications. This data base could be used for range unit planning.

3. From 1977-78 to 1983-84, 153 Coordinated Resource Management Plans were developed and approved for funding. These have helped achieve Ministry of Forests' range management objectives and have temporarily reduced

conflicts between livestock producers and wildlife managers. Total Crown range under Coordinated Resource Management Plans to March 31, 1984 is approximately 4.9 million hectares, which is greater than 50% of the total Crown range used by livestock.

4. The Knapweed Action Committee was formed in 1977. By 1982 the knapweed containment program included areas supporting approximately 200,000 AUMs in the Cariboo Forest Region, 50,000 AUMs in the Kamloops Forest Region and 40,000 AUMs in the Nelson Forest Region. Within the containment areas, knapweed spread has been successfully contained. However, the knapweed containment program was reduced in 1983 and 1984 and further staff and funding reductions in 1985 could mean complete loss of the containment program.

5. In 1976, the branch undertook the seeding of clearcuts to domestic grasses and legumes in response to a request by the British Columbia Cattlemen's Association. The seeding was accompanied by a monitoring program to enable treatment evaluation.

6. In 1983, the branch developed a range inventory strategy; and in 1984 initiated a pilot project on selected ranges in the East Kootenay.

7. The following are just a few of the many research projects undertaken during the last few years: (1) range condition and trend analysis; (2) ecological classification and description of wetland ecosystems of the sub-boreal spruce subzone of the Cariboo Forest Region; (3) seasonal forage production and nutritive quality of native forage throughout the growing season in Prince Rupert Forest Region; (4) interactions between bighorn sheep and cattle on Ashnola ranges; (5) biological control of knapweed; and (6) satellite remote sensing of knapweed-infested rangeland.

Issues

1. The appropriate allocation of range resources between livestock and wildlife is a major issue in some parts of the province (e.g. in the East Kootenay portion of the Nelson Forest Region and in the Cariboo). The Ministry of Environment is responsible for controlling wildlife populations while the Ministry of Forests is responsible for controlling livestock numbers and distribution as well as forage production. This division of authority results in overabundance of wildlife in some areas and underabundance in others. As well as resolving this issue, further research on wildlife and livestock forage, nutrient and habitat requirements needs to be undertaken so that forage can be allocated appropriately.

2. Another major issue is the need to continue the Five-Year Program as an effective administrative and planning tool. For range management, a five-year plan is crucial so that range opportunities can be objectively, qualitatively and quantitatively compared with wood-fibre production, recreation and other uses of the forest land base. Unless this is done, rational management decisions cannot be made.

3. The Ministry of Agriculture and Food has historically disbursed federal funding for range improvements. Benefits have accrued to range users, wood-fibre users and other users of the forest. The Agriculture and

Rural Development Subsidiary Agreement with the federal government expires at the end of the 1984-85 fiscal year. Negotiations are now underway for a replacement agreement. Continued cooperation with the Ministry of Agriculture and Food is necessary to ensure:

(1) adequate funding and support for range activities;
(2) development and publication of the Coordinated Resource Management Plan manual;
(3) development of a data base on range improvements; and
(4) review of operating Coordinated Resource Management Plans and the planning process.

4. The Ministry of Environment contributes some funds to range improvements but greater involvement is needed to match the proportionate gains in wildlife benefits.

5. Quantitative planning by the Planning and Inventory Branches has been almost totally oriented toward forestry uses of the land base. To ensure that forage and other resource uses are considered, a preharvest assessment should be done on all forested land within timber supply areas, tree farm licences and other forest tenures, with input coming from all relevant branches. Range input will require improved range unit planning and research on tree-forage-livestock interactions.

6. The knapweed containment program in Kamloops and Nelson Forest Regions must be continued and expanded.

7. Grass seeding of clearcuts, under proper management conditions, is one of the most cost-effective means for achieving the Ministry of Forests' range goals. The program to seed appropriate clearcuts in areas adjacent to ranches requires continued support.

8. The Range Management and Inventory Branches need to develop a strategy for mapping range unit boundaries and improvements into the inventory graphic data base (I.G.D.S. system). Unless this is done, most range maps will be delayed several years.

RECREATION MANAGEMENT PROGRAM

Recreation management is one of the ministry's three primary resource mandates. It is an important component of integrated resource use planning and management on provincial Crown land where the Ministry of Forests has resource jurisdiction. It is different from, but complements, the outdoor recreational programs of other agencies on Crown land; principally that of the Ministry of Lands, Parks and Housing.

The primary objective of the Recreation Management Program is to identify, protect and maintain the recreational and aesthetic values and opportunities of the forest resource. Developing recreation sites and trails is an important secondary objective, aimed at providing safe, sanitary conditions with minimum site modification to facilitate public enjoyment of the natural surroundings. These developments are kept rustic and low key by intent. Other agencies and the private resort sector provide more sophisticated facilities for those seeking extra services.

Before the revision of the Forest Act and the ministry's reorganization, recreation was part of the Management Division. In 1980, the Recreation Management Branch was formed and recreation personnel were appointed in all six regions and 46 districts. This was accompanied by a corresponding increase in funding and a stronger emphasis on recreation management and planning.

Functions

To help meet resource management objectives, an inventory of recreational opportunities and facilities is compiled and updated as a standard component of the program. The first provincial summary of this inventory, which covers all forest land outside tree farm licences, was completed in April, 1984 and is included in a Background Report. In addition, user studies are undertaken to identify public demand for recreational values.

Landscape management also contributes to the goals of resource management by protecting scenic values. Guided by the Forest Landscape Handbook and supported by qualified staff in four of six regions, landscape management made considerable gains and has been well accepted by regional and district staff. Only one of these positions is currently filled.

Activity management includes access management, site and trail development and maintenance, hazard abatement and provision of information to recreational users of Crown land regarding the program, access, safety and outdoor etiquette. These operational aspects of recreation management are sometimes erroneously seen as the whole program.

Ministry standards are in place for site and trail development and maintenance. The standards aim at low profile development to provide safe, sanitary conditions with minimum site modification.

Initiatives

An inventory of recreational and landscape features for all forest districts has been completed recently. This makes the province one of the few major administrative units on the continent to have in place an operationally oriented inventory of forest recreational values. Further refinement and updates will provide a continuing basis for integrated planning.

Since inclusion of recreation into integrated management is a new component of provincial forestry, training programs will be set up for industry and ministry staff to teach them the principles and procedures. This will be a major project over the next three to five years.

Issues

The issues under the Recreation Management Program fall into two groups: (1) those related to protecting and maintaining forest recreational values, and (2) those related to providing and maintaining sites and trails.

Group 1. When integrated resource use management is practised effectively, recreational opportunities can be protected and controversy minimized. Conversely, when it is not practised, resource issues can become polarized with the resultant controversy having an adverse impact on all the ministry's programs.

The ministry has the mechanisms to achieve the desired integrated management but in practice, success levels are variable. Some of the factors that prevent effective, holistic integrated management plans from being developed are discussed below.

Some relevant statutes lack clarity about recreation mandates. The Forest Act and the Ministry of Forests Act charge the Ministry of Forests with managing forest-oriented recreation. Unfortunately, the responsibilities are not clearly defined. The mandates of other ministries, as they relate to outdoor recreation, also have ambiguous references. These can result in ill-conceived interpretations, overlaps and gaps. This has led to misunderstandings regarding the principles of integrated management, particularly as it pertains to the Recreation Program, both in the ministry and in industry, and thus to less than whole-hearted participation.

Accountability for program performance is difficult to define and enforce both within the ministry and the forest industry. A shortage of staff, split positions (one person looking after more than one program) and recent changes in program planning and budgeting procedures that differ from the ministry's original management system and program structure contribute to this difficulty.

In-service landscape expertise is lacking and needs to be redressed. This capability is needed to protect scenically sensitive areas important to public enjoyment and to anticipate and mitigate the adverse visual impacts of proposed logging activity.

The multi-agency approach in recreation and in managing the resource base can also lead to problems. Interministerial protocol agreements developed to harmonize the activities of different agencies are only partially successful. Currently, protocol agreements are in place between the Ministries of Forests and Lands, Parks and Housing regarding forest and nonforest uses and regarding a division of recreation responsibilities, but no formal protocol agreements exist between the Ministries of Forests and Environment. The Outdoor Recreation Coordinating Committee still exists, but it is dormant. Recent changes in other ministries have affected Ministry of Forests functions but are not yet fully assimilated.

A real need exists for some government-wide definitions of the forest resource, its components, corresponding management needs and responsibilities. With better defined bases, principles and mandates, more rational responses to short-term crises would be possible and personnel would be able to fill their roles more effectively.

Group 2. Site and trail development has been kept at a maintenance level for the past two years. As a result, instead of keeping up with the growth in demand or fulfilling the originally approved program goals, the quality and quantity of sites and trails has decreased and all facilities have deteriorated. At the same time, use has increased.

HARVESTING PROGRAM

The Harvesting Program's primary objective is to manage the province's timber resources so they provide the greatest economic and social benefits consistent with meeting environmental goals. To meet this objective, a number of functions must be performed including:

- estimating the timber supply available for harvest,
- regulating the rate of harvest,
- allocating rights to various members of the industry,
- ensuring efficient access development,
- determining a fair price for Crown timber, and
- integrating harvesting operations with the recreation and range programs of the ministry and the resource programs of other agencies.

These functions are performed by its five subprograms: Planning, Inventory, Timber Management, Engineering and Valuation. Each of the subprograms is described in the following sections.

PLANNING SUBPROGRAM

The objectives of the Planning Subprogram are to develop and direct the planning systems for integrating the use of forest and range land. This subprogram provides a systematic process to prevent piecemeal planning that would result in confusion of priorities and conflicts of goals and objectives. It integrates all Ministry of Forests' resource management objectives and takes into account the objectives of other resource agencies and, where conflicts are identified, suggests alternatives for their resolution.

Functions

The Planning Subprogram develops planning systems and plans at different levels: Forest Management Plans for Timber Supply Areas (TSAs) and Tree Farm Licences (TFLs), Local Resource Use Plans, and Resource Development Plans.

Forest Management Planning. Forest management planning establishes broad management strategies, including the allowable annual cut and the location of operating areas.

The Resource Planning Section of the Planning and Inventory Branch conducts timber supply analyses to assess future timber supplies and establishes timber supply management goals over both the short term (0-20 years) and the long term (one or more crop rotations). It uses forest planning models, inventory allocation models, and other models to forecast timber supply levels and to schedule timber harvests. The information produced is used to develop forest management plans for TSAs and TFLs.

TSA plans provide a basis for developing and coordinating the timber, range and recreation management programs carried out within a TSA. The plans must consider the resource values, be consistent with the programs and priorities of the ministry's approved Five-Year Program and analyze needs and opportunities within the TSA. They must also present feasible management options for future programs and provide guidance for the preparation of more detailed plans to be developed in accordance with the ministry's planning system.

For each TSA, the TSA plan establishes:

- supply objectives for timber, range and recreation, expressed as quantitative, long-range supply forecasts, based on data from the Inventory Subprogram and the Research Program on growth and yield;
- resource use assumptions underlying stated objectives;
- management strategies for timber, range and recreation (including harvesting priorities, fire and pest protection and suppression priorities, major access routes, utilization guidelines and required silvicultural regimes) used for preparing district annual five-year program proposals and for coordinating local and development plans;
- the location of operating areas over the next 20 years.

The Chief Forester uses this information as well as information received from the industry, other agencies, and the public to establish the allowable annual cut for a five-year period.

Once the allowable annual cut has been established, tentative 20-year operating areas are located. These areas are adjusted to take into account other resource uses and conflicts with other licensee areas. The process includes detailed examination of access and operability, harvesting sequences, patterns and priorities, mill requirements by species and sizes, and silvicultural and forest protection requirements.

The procedures used to develop TFL management and working plans closely parallel the procedures followed in TSA planning.

The TFL licensee prepares the plans which are reviewed by ministry planning staff. Once required revisions are made, the Chief Forester approves the management and working plan and the allowable annual cut for the following five-year period.

Local Resource Use Planning. Local resource use planning establishes integrated resource management guidelines for areas within TSAs and TFLs where development is proposed. Area-specific, integrated resource management objectives and prescriptions are established for such land units as community watersheds, range units and high-use, visually sensitive recreation corridors. How complex the plan is depends on the potential impacts and conflicts that might arise from the resource use; and the approval process ranges from tacit approval to proceed directly with development planning, to a comprehensive appraisal of the proposed development area, to intensive interdisciplinary planning studies leading to a local plan.

Resource Development Planning. Resource development planning ensures that developments are consistent with management plans and local plans. The process includes district level planning by the ministry's Forestry and Timber, Range and Recreation Divisions, and development planning by timber and range licensees.

Resource development plans generally cover five years and specify location, size, shape and orientation of cut blocks and the methods and schedules for renewing and protecting the resource. They are required for implementing TFL management plans, management and development plans required of forest licence and timber sale licence timber tenures, range unit plans and various ministry plans such as recreational site development plans, silviculture development plans and major road development plans.

Initiatives

Between September 1979 to September 1984 a number of significant projects were undertaken within this subprogram. It established the present 33 provincial timber supply areas; prepared policy and procedures for administering Provincial Forests and established 41 new Provincial Forests; designed a forest planning computer model and computer-based system for evaluating alternative management strategies for timber supplies within TSAs; formulated policies and guidelines for integrated resource use management of forest and range lands; published a Forest Planning and a Public Involvement Handbook; and prepared Timber Supply Analysis Reports for all TSAs and many local resource use and development plans, a number of which formed the basis for land decisions by the Environment and Land Use Technical Committee and the Environment and Land Use Committee.

Issues

Regional Priorities. At present the Planning Subprogram has only provincial policy to guide its activities. Experience has shown that this is not specific enough to guide decisions at the TSA and TFL level. The ministry must establish priorities between and within TSAs and TFLs and identify incompatibilities with other agency programs.

Administrative Units. TSAs frequently extend beyond district boundaries so that a district manager has to deal with more than one TSA. This not only complicates planning and management, but results in the regional planning staff having to develop the TSA plan, whereas the district manager responsible for its execution should develop it. Since the district is the administrative level for implementing forestry operations, boundaries should be adjusted so that each district contains a single TSA, where feasible.

Similarly, TFLs sometimes extend beyond district boundaries. In such cases, consideration should be given, where logistically feasible, to amending district boundaries so that the entire TFL can be administered by one district manager.

Delineating Operable Land. Each TSA contains areas of marginal forest land considered unsuitable for long-term timber production. These area are particularly prevalent in the Prince Rupert and Prince George Forest Regions and can readily be delineated by ministry staff. Nonetheless, the gross operable land base contains individual timber types and growing sites not expected to contribute fully to the long-term timber supply. The way that their net contribution is presently determined is inadequate. Ways must be found to incorporate economics so that operability can be established on the basis of wood costs delivered to a manufacturing centre. Solving this complex problem will likely involve the use of digital terrain models and other sophisticated techniques to deal with the biophysical and economic parameters affecting operability.

Yield Information on Managed Stands. More and better yield information on managed stands will be needed to predict yields from stands subjected to specific treatments. This information is needed, not only for timber supply management (to select the most cost-effective forestry programs), but also to determine the appropriate "incentive increases" for licensee initiatives in accordance with the Forest Act.

Internal Coordination. If the Planning Subprogram is to improve its effectiveness and efficiency, ways must be found to improve the linkages between ministry programs. This would ensure the consistent use of TSA plans and TFL management and working plans and would improve understanding between individuals responsible for developing and administering forestry program activities.

Integrating Resource Use. Ways must be found to encourage resource ministries to work together to develop integrated resource management objectives. More use of planning models that consider yields and values of other resources such as fish, wildlife, recreation and visual quality could help to improve coordination between the Ministry of Forests and other ministries.

The Relationship Between Management Plans and Five-Year Programs. At the present time, TSA plans and the TFL management and working plans are not compatible with the ministry's Five-Year Program. Further development and use of computer systems may assist in integrating ministry program and plan development.

Privatization of Forest Management. The current trend towards privatizing forest management responsibilities through granting additional tree farm licences could upset the age class balance within affected TSAs and could result in reduced harvest scheduling flexibility in the TSA which is needed to achieve maximum volume production. This could be resolved if, before approving new TFLs, timber supply analyses were undertaken for the entire TSA and for the TSA less the TFL application to determine the net effect on the long-term wood supply and on management implications.

Timber Supply Management. The ministry must place more emphasis on its public information program so that individuals, environmental groups and other forest-oriented organizations will have a better understanding of this yield regulation policy and how it differs from the traditional concept of sustained yield management.

Public Involvement. The Public Involvement Handbook published by the ministry in 1981 filled several needs at that time. It illustrated the ministry's commitment to public involvement and provided a rigorous definition of basic concepts as well as outlining some good general forestry principles. The process encourages the public to become involved in providing opinions to guide the manager in the decision making responsibility.

INVENTORY SUBPROGRAM

The objective of the Inventory Subprogram is to provide comprehensive data about the forest resource. This is used to determine allowable annual cut and for day-to-day management of the forest resource. The inventory provides data on volume, age, species composition, growth rate and site quality.

Functions

The Inventory Section of the Planning and Inventory Branch is responsible for developing forest inventory methods, producing forest inventory maps, and compiling and maintaining inventory statistics for forest resources on all provincial Crown lands. These responsibilities entail managing the data base, annually updating forest cover maps and associated data files, deriving and producing growth-and-yield and decay-and-waste statistics, and monitoring forest depletion. All collected information is incorporated into detailed maps and statistical tabulations, which enable harvest rates for timber supply areas to be calculated.

Conducting the Inventory. Quantitative descriptions of forest and range resources are generally required at five levels of statistical detail: (1) provincial, (2) regional, (3) management unit, (4) management subunit and (5) operational unit.

Provincial and regional inventories are compiled entirely from aggregated data obtained at the management unit, subunit and operational levels, and include the inventory data bases of tree farm licences maintained by licensees. The methodology used in these inventories is documented in the appropriate working plans.

The data base consists of over 7,000 forest cover maps; descriptive statistics; growth and yield data; and volume, decay, waste and breakage statistics. Statistics are produced for all timber supply areas, which cover between 0.5 and 14 million hectares each. Total timber volume is estimated within ± 10% statistical accuracy at 95% confidence level.

Inventory procedures and standards were revised in 1978 but much of the existing data base comes from earlier surveys. The new inventory system is based on aerial photo mensuration, supported by ground sampling. Homogeneous forest and range types are described in considerable detail in terms of the classification system.

The process involves pre-typing the conventional aerial photographs into homogeneous strata. Then homogeneous strata boundaries are transferred via Kail plotter to base maps. Each stratum or type is given a unique number both on the maps and on the aerial photographs. During the field season, aerial photo interpreters work closely with the field crews to obtain samples of various strata.

Sampling intensity varies with the type of inventory: in management unit surveys, generally less than 1% of the area is covered by sample plots, whereas in subunit inventories, approximately 5% of the area is sampled with photo and ground plots.

This methodology is basically multi-phase, stratified, random sampling, using large-scale aerial photo plots and ground samples within the context of double sampling. This system is recommended for management unit and subunit inventories; however, multi-stage sampling, sampling with partial replacement or other random sampling systems might be equally efficient, depending on the inventory's objectives.

In June 1978, the Inventory Branch acquired the Interactive Graphics Design System (IGDS) which has replaced conventional draughting. Currently, all forest cover maps are being digitized with the aid of IGDS. The computerized mapping system provides area summaries by polygons as well as major strata (growth type or species composition, age class and site class); the corresponding average volumes per hectare are obtained from the photo and ground samples. The final step in the preparation of inventory statistics is the merging of map-related data with those obtained from samples.

To annually update forest type maps and statistics for such a large data base, the most sophisticated technology available must be used. High altitude aerial photography, generally at a scale of 1:40,000 to 1:60,000, has been the primary tool used for updates but this is being replaced by satellite imagery in digital form.

Producing Growth and Yield Statistics. Since 1977, nonlinear volume-over-age equations and computer plotted volume over-age curves have replaced handdrawn curves to provide information on growth rates of forest stands. These equations are currently being revised with the new form including crown closure and basal area as additional independent variables.

A higher resolution component of the growth projection system is the stand-growth modelling approach. This consists of predicting the growth and development of forest stands in terms of variables other than volumes, such as diameter at breast height and height distribution functions. Since the new inventory system uses large-scale aerial photographs and photo mensuration, it is operationally feasible to link a stand-growth modelling system to the new inventory data base. Operational tests are being carried out to pursue this approach further.

Decay, waste and breakage factors for all forest inventory zones are used to reduce gross volume to a realistic net volume at close or intermediate utilization standards which is corrected for decay only or for various combinations of decay, nonrecoverable waste and breakage. The factors are subject to periodic change as more information becomes available and as further analysis indicates a better grouping of the data.

Initiatives

The single most pressing challenge facing the Inventory subprogram is to maintain, and where possible enhance, the level of productivity, stability and continuity in inventory data collection, statistical production and processing, and report and map production.

The challenge is being addressed with a high degree of success through technological developments, technology transfer, data sharing, optimum use of data and involvement of the private sector. Examples of progress include the following:

- forest cover overlays have been digitized by the private sector;
- computer assisted mapping design files (e.g., forest cover overlay) and preclassified digital satellite imagery have been transferred to a microcomputer. This capability has been developed further to allow the map and satellite data and the update of forest cover polygon boundaries and attributes to be displayed simultaneously;
- software from the British Columbia Systems Corporation main-frame computer has been down-loaded onto an in-house VAX 11/780, resulting in considerable cost savings;
- forest inventory depletion updating procedures have been developed on the in-house VAX 11/780.

In addition to the above technical developments, a new branch organizational structure is being developed that emphasizes (1) producing operational statistics, reports and maps, (2) transferring information and technology to regions and districts, and (3) reducing activities not absolutely essential for producing data needed for managing provincial forest resources.

A distributed data network to the district offices is needed to allow access to inventory data by line managers. This requirement is being discussed with the Systems Services Branch.

Issues

1. The Inventory Subprogram will, in the short term, be able to support the provincial forest inventory data base on a maintenance level without significantly affecting the level and quality of data and services. Additional sampling for growth and yield and decay is needed. However, the active participation in such organizations as Committee on Standards of Measure and Data Sharing and the use of cruise plot data will do much to alleviate data shortfalls.

2. Section 88 funding for inventory works on tree farm licences and funding for the provincial conventional air photography program needs to be clarified. The provision of adequate resources for these programs is essential for maintaining current tree farm licence inventories and for updating descriptions of forest types in immature stands.

3. The development of electronic data processing technology will have major implications for the storage, distribution and use of data. Since the Inventory Subprogram is primarily concerned with data, statistics, reports and maps it will have to be responsive to these changes.

   To provide the most effective means for gathering, processing and reporting data while serving the interests of the Crown, the following changes need to be made:

   - the private sector should be encouraged to participate in the data collection and digitizing of forest cover maps;
   - the sharing of information between branches and ministries should be encouraged to avoid any duplication or unnecessary data collection;
   - procedures should be implemented to provide line managers with the ability to access and process data through distributed data and processing networks;
   - program changes should be made to improve regional and district knowledge of the data available and its application.

ENGINEERING SUBPROGRAM

The Engineering Subprogram's primary objective is to ensure that forest access roads and other structures and equipment related to logging will provide efficient harvesting and transportation of timber while being consistent with environmental goals and other forest resource uses. The following functions contribute to meeting this goal:

Functions

The Engineering Subprogram provides forest engineering input for resource management decisions, investigates engineering problems, analyses data and policy alternatives and makes recommendations regarding suitable options. It also develops and coordinates access plans that recognize the need for environmentally sound, yet efficient, transportation systems. Engineering standards and procedures are developed to ensure that the most appropriate harvesting and transportation systems are used for a given situation, whether it be for long-term primary access or emergency access to facilitate fire control or salvage operations in insect infested timber.

The subprogram is instrumental in ensuring that the survey, design and construction of roads and bridges for reaching the forest resource is performed to appropriate standards. To facilitate this, equipment lease and rental rates are established and a sound method of road evaluation is developed. All engineering works are monitored to ensure they are being completed according to specifications, on schedule and within budget.

The subprogram is also responsible for establishing engineering standards for equipment design and fabrication. It assists the silviculture program in developing site preparation tools and equipment, herbicide and pesticide application equipment, brush control tools, precommercial thinning tools, and in assessing commercial thinning machines and methods. It also conducts productivity studies, cost analyses and work method evaluations of machines engaged in harvesting or reforestation activities.

The subprogram also undertakes special projects involving economic analysis of wood processing plants and utilization of the timber resource.

Forest Service roads are administered through the Engineering Subprogram consistent with the Forest Act and Regulations. Roads and their rights-of-way through Crown and alienated land are located, acquired, used and administered to provide access to the forest resource.

Achievements and Initiatives

During the past few years the Engineering Branch undertook transportation studies, break-even cost analyses and cost/benefit analyses for the B.C. Rail Dease Lake Extension Study and the Revelstoke Dam Project; it developed engineering manuals and estimating guides for determining road construction costs and some silvicultural process costs; it developed a computerized system for the Road and Bridge Register, which in conjunction with the automated road recorder (also developed by the Engineering Branch), allows all log truck haul routes to be rapidly surveyed; it developed the log haul simulation model, the forest road design system and the bridge management system; it developed the ball and chain land clearing device, V-blade scarifier, and spot scarifier attachment prototype, all for use in site rehabilitation; and it undertook special studies to establish guidelines for harvesting methods that take into account environmental and economic impacts.

In addition, the Engineering Branch has been responsible for obtaining rights-of-way through some 250 separate parcels of land on approximately 100 Forest Service Roads over the past few years. By so doing, vast areas of provincial forest land have been made accessible for harvesting.

In addition, new initiatives are under way. The Engineering Branch with assistance from the Systems Services Branch has initiated a pilot harvest-mapping project using digitized geographic inventory data from the

Inventory Branch. The unfavourable economics of harvesting and transporting timber in many parts of British Columbia is a major problem in forest management. Harvest mapping will provide information on present and future harvest problems, determine whether an area can be harvested economically given lead time to develop economic harvest methods, assist in reducing the problem of isolated timber resulting from first pass harvesting, and help with scheduling access development and silvicultural practices.

A coordinated access management plan is being designed that will enable the Ministry of Forests to manage an ever-increasing number of roads with fewer funds. Forest roads are used not only for transporting forest products but for recreation, range, silviculture and protection access. They also provide access to ecological reserves, parks, mines, utility rights-of-way, etc. Thus, access planning and maintenance requires coordination among the ministry's programs and between the ministry and other agencies, companies, business associations (e.g. B.C. Cattlemen's Association, the Guide-Outfitter's Association) and public groups.

The coordinated access plan developed by the Engineering Branch has been implemented with great success in one major drainage and is being implemented in another, and the Engineering Branch has proposed that this system be implemented on a test basis in two other districts. After an evaluation of the results in all three districts, standardized policy could be formulated for coordinated access management and a training program could be undertaken to implement the system in all districts.

A foreseeable benefit derived from this access management plan is the sharing of access development cost by various natural resource developers. As mature timber stands are depleted and harvesting is directed toward smaller, lower-grade timber in less accessible locations, the access development becomes relatively more expensive and difficult to amortize. Thus, amortization of access construction costs over other resources would be highly beneficial. The North-East Coal Development, and particularly the access into Tumbler Ridge, provides a good example of locating and designing access to serve more than one resource user. Sharing of construction could be easily accommodated through this proposed coordinated access management program.

Issues

1. During the past five years or so, a backlog of several hundred access roads has accumulated for which rights-of-way have not been acquired. Since rights-of-way for all major proposed access roads must be acquired before beginning construction, operational priorities have been placed on the most pressing problems.

   To alleviate the situation, timber allocation should not begin until legal, unhindered access to the timber is obtained through alienated lands (e.g., private properties, leased lands, Indian Reserves, and over such areas as mineral claims, railway crossings, gas and oil pipelines). So, the current linear process needs to be replaced by a triple track process in which the proposed timber allocation is followed simultaneously by a proper status report, location survey and property negotiations.

2. Over the longer term, increased expertise is needed at the region and district levels in areas of river, structural and geotechnical engineering (stream side and crossing management), transportation management (road systems, trucks and trailers, railways, water transportation and air transportation) and equipment development (harvesting, silviculture, road and bridge maintenance, forest protection).

TIMBER MANAGEMENT SUBPROGRAM

The Timber Management subprogram is responsible for all activities relating to the harvesting of Crown timber, including issuing timber contracts and tenures, maintaining a comprehensive inventory of all relevant data and documents, registering timber marks under the terms of the Forest Act and dealing with all matter involving timber trespass on Crown forest lands.

As harvesting timber is one of the primary administrative responsibilities of the Ministry of Forests, the timber management subprogram is both large and diverse. A synopsis of the main functions is given below.

Functions

The principal function of Timber Management Branch relates to issuing and administering the timber tenure system. This is a very formal process that provides a legal basis for protecting the rights of the Crown and the members of the forest industry to obtain specified benefits from the forest resource. Timber Management Branch divides the allowable annual cut for a management unit among the various tenure holders through an apportionment process. This establishes the basis for commitments of timber supplies to licensees.

A record of timber processing facilities, including plant capacities, is prepared and maintained in conjunction with Strategic Studies Branch to assist in future apportionments. A more detailed description of timber tenures is included in Chapter E2.

Timber Management Branch is responsible for determining whether land involved in an application for a forestry use is available for that use. This requires ensuring that the rights to the land have not been previously assigned nor any other encumbrances or reserves placed on it. The Forest Atlas, which the Branch maintains, together with the Official Provincial Reference Map, provide the basis for producing land status map reports.

Timber Management Branch also maintains official key maps of the Provincial Forests and sponsors amendments which are made by Order-in-Council.

Exhibit A sketches are maintained which are legal plots comprising a title block and planimetric drawing showing the area of a tenure agreement or application in relation to topographic and cadastral surveys. The Exhibit A sketch is an integral part of an agreement since the area's identification rests on it.

Most assignments and transfers of a majority interest in timber holdings require the approval of the Minister. Timber Management Branch analyses and evaluates the effect such change would have on the local economy, industry and the province as a whole and then makes an appropriate recommendation for or against the change to the Executive and the Minister.

Timber mark certificates covering private lands and timber marks for public lands are issued to identify origin and ownership of timber, to account for charges payable and to indicate whether the timber is exportable or not. A Timber Mark Registry by mark character, name of holder and the land to which the mark pertains is maintained as well as a register of marine log brands under the Forest Act and boom chain brands under Boom Chain Brands Act.

Accomplishments

The 1976 Report of the Royal Commission on Timber Rights and Forest Policy urged reform of the forest tenure system to make it administratively less complex. The Forest Act now embodies this recommendation. Following proclamation of the Ministry of Forests Act and Forest Act on January 1, 1979, the Timber Management Branch began working on implementing the new system. The first task was converting 85 public sustained yield units into 33 timber supply areas located in such a manner that timber could logically supply processing plants located within the same unit. As allowable annual cuts were established for each of these TSAs, the apportionment process confirmed or established a pattern of timber commitment which is expected to last for decades, although it will usually be reviewed every five years. Besides assuring the amount of the log supply from each timber supply area that a licensee can rely upon to meet requirements of processing facilities, it established the volume of timber available to operators under the Small Business Enterprise Program.

The Forest Act brought about the need to replace all tenures, as well as to convert most of the old forms of tenures into new ones. Much of this major task has now been completed. There will still be a major workload in replacing forest licences in the latter part of 1987, which is the end of the first five year interval.

The Small Business Enterprise Program started in 1979 but until 1982, little timber was available under the program. At that time, Crown timber began to be offered to registered small business operators, by competition, in short-term timber sales. In 1982, the Minister apportioned a volume of timber in each timber supply area to be sold only to registered small business operators. Minor additions have been made recently with an objective to make further increases in the future.

The Woodlot Licence Program is a special aspect of the Small Business Enterprise Program. Through it, a substantial number of provincial residents can become involved in forest management by granting them up to 400 hectares of Crown land under licence to be managed along with any private forest land they may hold. This will enable the ministry to extend sound forestry practices to some private lands while providing secondary job and income opportunities to the licensees. One percent of the provincial allowable annual cut, exclusive of Tree Farm Licences, is assigned to the Woodlot Licence Program.

The Woodlot Licence Program has been active since late 1982 and many applications have been reviewed. Nine licences have been awarded and 60 applications have been cleared for processing. The program is expected to be fully implemented by the end of 1986.

Trends and Issues

The major challenge in the timber management subprogram is developing and administering the regulatory requirements of the Forest Act with a smaller work force. Electronic data processing has been introduced to aid some functions and will be expanded to encompass mapping, Crown land information, the timber marking system, cut control, contractor clause, statistical reports, apportionment listing, tree farm and tree farm licence listing, committee listing, woodlot listing and any other areas where efficiencies can be gained.

Land status and maintenance of the timber tenure records remains a mapping problem. A pressing need exists for adopting a unified resource mapping system to cover base maps, cadastral surveys and forest cover. At present, legal descriptions often do not match forest cover maps. An interagency committee headed by Technical and Administrative Services Branch has been struck to resolve these differences.

The complexity of administrative boundaries makes mapping difficult. The overlapping array of boundaries for regions, timber supply areas, districts and provincial forests needs to be simplified but the effort required to do this is more than present staffing levels will permit. The possibility of issuing new tree farm licences adds to the complexity. Computerized mapping systems may help with the drafting but the legal descriptions will still need to be prepared since they are the basis for administering the whole timber tenure system.

The Forest Act provides that holders of timber sale harvesting licences, timber sale licences and forest licences may apply to have them replaced by a tree farm licence. Issuing new tree farm licences raises questions in timber administration regarding decreased flexibility in managing timber supply areas, impacts on species/age distribution and quality of timber remaining in the timber supply area, and problems that may be caused by catastrophic events such as fire and insect outbreaks.

Another issue related to tree farm licences concerns the set of obligations the licensee will assume. Most existing licences were issued when the province was interested in stimulating development of timber processing facilities. The industry's commitment to build and maintain these facilities was considered adequate to compensate the public for the issuance of timber rights. Today, the province has extensive manufacturing capacity and demand for timber exceeds supply. In this circumstance, when new tree farm licences are awarded they should carry other publicly desirable commitments such as continuing investment in intensive forest management.

VALUATION SUBPROGRAM

The purpose of the Valuation Subprogram is to obtain a fair return for the sale of Crown timber while encouraging a vigorous, efficient and world competitive forest industry. Care is taken to ensure that members of the industry receive equitable treatment that recognizes the wide variation in timber quality and logging costs.

The Valuation Subprogram is responsible for determining prices for Crown timber, for issuing invoices on the sale of Crown timber and for handling matters related to forest products export and log salvage. These functions are described in the following sections.

Functions

Stumpage Appraisal. The purpose of the stumpage appraisal process is to determine, in a systematic and equitable manner, the stumpage rate that a licensee should pay for cutting Crown timber.

Determining stumpage rates requires accurate information on product values, production costs, the site factors that influence these values and costs and, finally, the quantity and quality of the timber to be harvested. In order to acquire this information, the Valuation Branch undertakes or has the industry undertake the following activities:

1. Timber Cruising. This provides data on the species, quantity and quality of timber which govern the value of the timber, as well as data on the specific ground conditions and other features that affect the cost of harvesting the timber. The cruise is usually done by the forest industry but local forest district staff are required to approve sampling procedure and make random checks on the accuracy of the field measurements.

2. Monitored Productivity Studies and Cost Surveys. Costs are based on annual surveys of actual costs under varying operating conditions. Productivity varies considerably from stand to stand depending on timber and terrain characteristics. Identifying and quantifying these relationships is a major activity involving regional and industrial participation. Data are collected on harvested volumes, machine times, site conditions, equipment and crew size.

3. Lumber recovery studies and manufacturing cost surveys. These studies are conducted to determine the cost of converting logs to lumber for specific species, sizes and qualities, and the quantity of lumber and chips obtained. They provide the data required for interior (lumber-based) appraisals.

4. Collection of log and lumber selling prices. These figures are obtained monthly from actual sales of logs and lumber. The information is collected, verified and compiled into one and three-month averages by species and by price zones by the Valuation Branch. These prices are used in the immediate month following collection for new appraisals and for adjusting rates in existing appraisals.

Scaling. Licensed scalers scale logs removed from a sale area. Under the piece scale system, this involves identifying the species, measuring the length and butt and top diameter and recording the timber mark. Scale returns are completed in the field, then forwarded to the district or regional office for coding. The returns are then sent to the Valuation Branch in Victoria where they are entered into the computer system for processing into Scale and Royalty invoices.

In the Interior, most volumes are determined by weighing the load of each logging truck and applying a ratio to convert the weight to volume. The ratios are determined by scaling each log in randomly selected sample loads.

Billing. The billing process involves verifying the completeness and accuracy of stumpage appraisal data, computing the volumes cut using data submitted on scale returns, applying the appropriate charges, and issuing the scale and royalty invoices. The majority of invoices are for stumpage on timber cut. For historical reasons the invoice is still called "Scale and Royalty Invoice". The billing section also keeps historical computerized records of volume cut and invoices issued. The data can be retrieved to provide information on timber cut by licensees, marks, districts, etc., and is used extensively for this purpose.

Export of Unmanufactured Forest Products. The Forest Act requires that all timber harvested be used or manufactured in the province unless it is surplus to the requirements of provincial processing facilities, cannot be processed economically in the province or would otherwise be wasted. Chips, hog fuel, sawn timber with a cross-sectional area greater than 0.2 m², as well as logs, are considered not fully manufactured and, therefore, subject to these restrictions. Only timber on provincial land Crown granted prior to May 1906 is not subject to these restrictions.

The volume of logs exported varies from year to year. In 1981 it was 730,126 m³ compared to 2,308,168 m³ in 1983. And in 1984, the number of applications for exemption from manufacture in British Columbia grew from 156 in January to 309 in June. The majority of the logs exported has been harvested from the province's coastal region.

Issues

Appraisal. Ministry appraisal decisions have a significant effect on the financial success of timber processing firms. At one time, the price of standing timber was established by a simpler appraisal process with bidding setting the stumpage value in some cases. The elimination of competitive bidding, except for the Small Business Enterprise Program, has placed the ministry in the position of determining the stumpage value for the majority of the public timber resource. To ensure that timber quality, logging conditions and distance to market are properly and equitably reflected in the price, the process has become highly complex. At the same time, industry has placed increasing efforts into checking Forest Service procedures and arguing for concessions and changes in stumpage pricing policy.

The fact that much of the timber is valued at minimum rates, except during periods of buoyant lumber markets, has stimulated pressure for greatly simplifying timber pricing as a means for reducing the administrative costs to government and industry. This inevitably leads to the questions: Will security of tenure and pricing provide adequate incentives to industry to remain efficient and innovative in a world-wide, competitive market?; and will the government's obligation to safeguard the broad public interest in the timber resource be met?

That competition does lead to innovation and efficiency is evident from the Small Business Enterprise Program and from the fact that major licensees contract most of the logging. Furthermore, the cost-price squeeze that the lumber industry has experienced in the last three years has also led to greater efficiency in logging and milling. This implies that the Crown should not necessarily be satisfied with what is left after all other costs have been deducted. Rather it has an obligation to influence the level of timber harvest and ensure industry efficiency, employment and the integrity of the resource are being be maintained at optimum level.

The ministry, in consultation with the industry, is presently developing a provincial appraisal manual to replace the six regional manuals. The emphasis will be on:

- establishing average efficient operating costs by using the most up-to-date data as directly as possible,
- using measurable field variables rather than subjective data,
- eliminating insignificant factors and variables,
- conducting calculations on microcomputers in district offices to ensure appraisals will be completed promptly.

Other appraisal-related matters being addressed concern:

- incentives for utilizing low-value decadent stands and species,
- degree of compatibility between resource management objectives and appraisal policy,
- redefining criteria for Section 88 projects.

Clearer policies and a better delineation between ministry and private sector responsibilities should result.

Billing Delays. The production of scale and royalty invoices is slow. This impedes the collection of government revenues and creates a lack of information on volume and grades, which hampers administrative and management activities in the regions and districts as well as purchasing and trading transactions in industry.

The delays arise from slow determination of stumpage rates and the timelag between scaling and receipt of scale return by mail in Victoria. These problems are being addressed through a complete review of the Ministry revenue system. An overview report has concluded that significant savings in staff and time could be achieved through a decentralized computer system and the Ministry, upon approval from Treasury Board, will proceed with detailed design and implementation.

In addition, work is underway to develop a system for computing scale tallies in the field using handheld data recorders and small office computers. In cooperation with the Council of Forest Industries, operational trials of two prototype systems will be completed by December 1984.

Credit to Stumpage Payable Program (Section 88). The recent recession has placed the stumpage level at minimum in most areas resulting in historically low stumpage revenue. This has made it impossible for some licensees to offset all credits earned under Section 88 against the small stumpage payments that are generated. In addition, because of the current cash flow problems, licensees have been reluctant to incur more credits until the previous credits are offset and have curtailed much of their Section 88 activity. Thirty-three licensees in the province are in this situation.

The budget for the Section 88 program was reduced to $59 million for 1983-84 from $89.8 million in 1982-83. At the same time, an overhead allowance of 18 percent was transferred from appraisals to each Section 88 project. This effectively reduced the amount available for work to $50 million. This is inadequate for maintaining the basic silviculture program and the logging access road program. The former is essential for maintaining future forest crops, and the latter is essential for harvesting the present and future crops.

Timber Cruising. In the last two years, interest in cruise-based sales has been gathering considerable momentum as an alternative to establishing the volume cut by a scale. While such sales are simple and apparently provide incentives for better utilization, there are some major concerns. First, basing total stumpage on the cruise volume will demand more intensive cruising, especially in mixed stands and where high value species are present. Second, since the utilization standard is not directly enforced through penalty billings, standards must be included in the harvesting agreement. Otherwise, the stumpage values could be greatly underpriced.

With much of the timber harvested in the last three years being billed at minimum stumpage rates, industry has questioned the need for cruising. Reliable estimates of both harvesting costs and stand values demand good cruise data. Short-term savings on cruising will lead to inaccuracies and possible financial losses to the province.

Moves toward decreased cruising intensity and decisions to leave cruising-related positions unfilled are expected to adversely affect the Ministry's ability to accurately determine the quantity, quality and value of harvested Crown timber and management of the resource.

Export of Unmanufactured Forest Products. Because of the concern over the increased levels of log export, the government appointed a Log Export Advisory Committee in 1983 to review provincial policies and procedures. The committee examined the effects of log exports on domestic log supplies, on overseas markets for manufactured products and on employment in the province. It also examined the administrative procedures used to deal with applications for log export. Their recommendations include a revised fee in lieu of manufacture for coastal timber based on log quality and grade. Even so, the provisions for export remain contentious as many people equate it with a loss of domestic jobs. On the other hand, the premium prices paid for logs in this market helps to underwrite otherwise unprofitable logging operations that produce supplies for manufacturing here.

FOREST PROTECTION AND FIRE SUPPRESSION PROGRAMS

The ministry's forest protection role is achieved through two programs: Forest Protection and Fire Suppression. The purpose of the Forest Protection Program is to protect the province's forest and range resources from damage by wildfire, insects, diseases and other pests. By doing this effectively, the program can contribute significantly to the availability of timber supplies. It is also concerned with protecting life and property, preserving other natural resources and using prescribed fire wisely for resource management objectives. The purpose of the Fire Suppression Program is to provide the resources required to suppress wildfire in support of the Forest Protection Program.

The functions of these Programs are described in the next section followed by an account of the important achievements effected over the past few years and some of the major issues that need to be considered.

Functions

Forest Protection Program. This program provides all the fulltime staff involved in administering and managing both the Forest Protection and Fire Suppression Programs. It operates the forest fire prevention activities; the fire detection and fire control systems; the pest detection, evaluation and control activities and supportive air operations; and the planning, development and research functions. The program's activities fall into five categories:

1. Administration: This activity provides the administrative requirements for both the Forest Protection and Fire Suppression Programs and accounts for some 28% of the program's budget.

2. Fire Management: Fire management functions involve enforcing fire prevention regulations; managing the public relations programs dealing with public awareness and fire safety, the disposal and safeguarding of forest fuels and other hazardous materials; managing the use of prescribed fire; and operating the provincial fire weather network. It also provides fire detection through fixed lookout, aerial patrol and lightning location systems and is responsible for training and placing some fire attack crews. Fire management accounts for about 36% of the program's budget.

3. Pest Management: The pest management functions involve preventing forest insect and disease outbreaks; detecting, surveying and evaluating specific pest populations and their damage; and undertaking pest control operations. Public awareness and education programs and staff training are particularly important in this relatively new activity, as is the supervision and safe management of the ministry's use of pesticides. This activity consumes about 28% of the Protection Program's budget.

4. Air Operations: This activity is concerned with managing the high-cost air tanker fleet, the air tanker bases, aircraft contracts, the initial attack helicopter rappelling crews, and the flying for administrative purposes. Expenditures amount to 4% of the Protection Program budget. These costs cover only the salaries and associated expenses of managerial personnel; the costs of air service contracts and aircraft charters are charged to the programs and activities using them.

5. Planning, Development and Research: Innovative improvements to the total protection effort are this activity's prime function. Research and development projects and special studies on high-profile problems account for the majority of work undertaken. Another major function is the management of the protection data bases and computer systems. This activity consumes approximately 4% of the Protection Program's expenditures.

Fire Suppression Program. This program provides the resources for controlling and extinguishing forest fires and provides the funds to expand the ministry's core fire suppression forces when they are unable to cope with a fire problem. The program's expenditures fall into six categories:

1. Direct Fire Fighting: Once a fire has been detected, this activity funds all costs incurred in controlling that fire. It covers such items as firefighter wages, equipment purchases and rentals, food and other supplies, and the costs of helicopter initial attack crews. These costs account for about 47% of the Suppression Program's expenditures.

2. Fire Suppression Flying: The costs of helicopters and fixed wing aircraft, air tanker flying and base development and maintenance, and aerial detection and fire support flying services are charges to this activity which amount to 41% of its expenditures.

3. Fire Equipment: Replacement or new purchases of firefighting tools and equipment varies depending on the severity of the fire season but averages about 5% of the Suppression Program's expenditures.

4. Fire Standby and Overtime: The costs incurred by ministry staff in standby and overtime associated with fire suppression duties are charged to the Suppression Program and, while they can vary widely, usually average 6% of its expenditures.

5. Training: Training of ministry staff and extra hired firefighters in fire suppression techniques and personal safety is a charge of the Suppression Program, and amounts to less than 1% of its expenditures.

6. Fire Site Rehabilitation: Often, existing roads, bridges, fences and other improvements are damaged during emergency fire control operations. Fires may destroy all the vegetation and the soil's organic layers leaving the risk of soil erosion and stream flooding. Costs of corrective actions such as repairing improvements and grass seeding are charged to the Suppression Program under this category. They usually amount to less than 1% of its expenditures.

Initiatives

The 1979 Five-Year Forest and Range Resource Program Report identified protection needs which the Fire Protection and Suppression Programs have addressed over the past four years.

Fire Management. The program addressed the need to improve the efficiency of initial fire attack by:

- implementing a provincial lightning location system which provides real-time information on the location of lightning strikes. This system facilitates the routing and scheduling of air patrols and enables the early detection of fires started by lightning;
- expanding the use of airborne infrared scanners to detect hangover fires after industrial burning before they can spread;
- upgrading the air tanker program by replacing seven A-26 air tankers with more efficient Firecats, and by establishing tanker bases at Penticton and Dease Lake;
- upgrading helicopter capabilities with two modified Bell 205 helicopters which are used to deploy rappel attack crews to inaccessible fires. In addition, they were equipped with removable tanks to serve as air tankers and with on-board pumps to enable taking on and off-loading water while in the hover position;
- expanding and conducting standardized fire suppression training programs for ministry and forest industry personnel;
- modifying the numbers, types and locations of seasonal fire suppression crews, lookout stations and air tanker base personnel for more efficient response to changing fire load patterns.

The programs addressed the need to improve the effectiveness of large fire support systems by:

- improving the "overhead team" concept, where highly qualified fire control supervisory positions are organized so that ministry personnel in any region or district may be moved as a team to take over management of large fires in another district experiencing a heavy fire load;
- participating in the task force that developed the Canadian Interagency Forest Fire Centre at Winnipeg which coordinates the sharing of men and equipment between provinces and territories when any of them need support to handle an extreme fire situation.

To improve the cost effectiveness of fire control decisions in the far north, fire's ecological role was examined using field studies in the Fort Nelson, Cassiar and Mackenzie timber supply areas. Interpretive reports have been prepared and given to local fire managers.

The use of prescribed fire has been expanded to help meet both forest and other resource management objectives. The area burned has been increased from 20,500 hectares annually between 1976 and 1979 to 29,300 hectares annually between 1980 and 1983.

Annual targets are set for allowable area burned and timber volumes destroyed. For the province, these targets were established at 69,000 hectares per year and 2,570,000 m^3 per year. Each forest region was also assigned a performance standard. In the five-year period 1979 to 1983, the province met the area burned target in three of the five years, and the timber destroyed target in two of the five years. The Cariboo, Kamloops, Nelson and Vancouver Forest Regions essentially met performance standards in each of the five years. The Prince George and Prince Rupert Forest Regions, especially in their northern areas, failed to meet targets in three of the years. This was largely due to a series of severe fire seasons in northern boreal forests with above average lightning activity coupled with drought that created extremely difficult fire control conditions. Again, it is evident that the northern areas of the province are unable to cope with above normal fire seasons.

Pest Management. The Pest Management section has grown from two people who relied heavily on the scientific expertise of the Canadian Forestry Service, to a team of experts consisting of a manager, entomologist, pathologist, and vegetation and pesticide specialist at headquarters; pest management coordinators at each forest region; and specialists within some districts. Current plans call for an entomologist and a pathologist at each of the six forest regions and some enhancement at district levels.

Since its inception, the pest management team has done the following:

- initiated emergency projects to limit the spread of bark beetles and to accelerate the salvage of wood volumes, including conducting detection surveys, building access roads, doing sanitation harvesting and using trap tree techniques to attract and kill beetle concentrations. This program has not yet expanded to a fully operational capability;

- conducted spray trials using a virus and chemicals on the recent Douglas-fir tussock moth infestation. As a result of these trials, the test sprays can now be used operationally and should significantly reduce tree mortality when the next infestation occurs. Pest managers also provided planning and consultative services to the spray program against the tussock moth on private lands;

- undertook intensive surveys to determine the extent and severity of root diseases and leader weevils. Management plans are being improved on the basis of the findings;

- increased control measures in stands infected by dwarf mistletoe and established demonstration areas in the Cariboo and Nelson Regions to study the effectiveness of control measures over time.

Issues

Wildfire and pest management is a complex and expensive business. This is especially true in British Columbia where diverse forest environment, climate, and topography and variable unpredictable fire and pest losses make forest protection especially difficult. These difficulties are exacerbated by certain problems, which, if corrected or improved, would make forest protection both easier and more cost effective. The major deficiencies and issues are identified here.

General Forest Protection Issues

1. In order to provide cost-effective support to the objectives of timber, range and recreation programs, the Protection Program needs protection priorities and target levels for each timber supply area and each tree farm licence. In addition, a more sophisticated method to determine the impact of fire and pest losses over a forest rotation and their effects on the calculation of allowable annual cuts needs to be developed.

   Such improvements will reduce the number of managed units being overprotected at the expense of those being underprotected. Planning staff must assume the lead role in resolving these isssues.

2. High wages and high costs associated with equipment, machines and aircraft, often used under emergency conditions, have all made forest protection a high-cost business. To cope with these increasing expenditures, each cost-generating activity must be made more cost effective. In fire management, this could be done by (1) increased emphasis on systems development and computer applications that improve decision making (e.g. developing fire behaviour models, fire occurrence prediction models, fire fighting resource allocation models and aircraft productivity models); (2) developing value systems which establish priorities among resources and improvements at risk; and (3) understanding the effects of prescribed fire on ecosystems. In pest management, the major requirements for systems development lie in developing an historical data base for the major pests and developing models that portray their predicted impact with and without treatments.

3. **The salvage of fire killed or pest killed timber needs to be given a greater emphasis than it is now receiving. Any volume of damaged timber that is salvaged is not a total loss. However, because of insufficient coordination at the field level between Protection and Timber Management, damaged timber is not always salvaged. Not only is this wasteful but it reflects negatively on the Protection Program's success. Thus, coordination should be improved. In addition, different approaches might be necessary to ensure that the forest industry uses such timber. This might require some deviation from normal timber administration procedures or it might require freezing the logging of green sales until salvage areas have been logged. The Timber Management function must take the lead role here.**

Fire Management Issues

1. At present, the Protection Program is frequently called upon to protect life, property, animal habitat, domestic watersheds, transportation facilities and recreation areas from wildfire. These demands are increasing dramatically as housing developments continue to press further into rural and forested regions. However, funds are allocated only for protecting forest and range resources. Furthermore, the Protection Program's effectiveness is judged solely on its performance in protecting those resources. To correct this anomaly, the the Protection Program's role must be clarified: is it responsible for protecting only timber, range and recreation values or is it responsible for protecting life, property and other values as well? However this is resolved, the ministry must ensure that the funding level is appropriate.

2. Presuppression activities such as fire prevention, detection and initial attack have been reduced. This may lead to more and larger fires where the costs and damages will be infinitely higher than the original saving.

3. Wildfire losses in the northern areas of the Prince George and Prince Rupert Forest Regions in the latest five-year period 1979 to 1983, accounted for 85% of the provincial area burned and 84% of the timber volume destroyed. As indicated in the 1979 Resource Analysis, the fire control capabilities in northern areas are still not able to cope with above-average fire seasons.

4. The ability to cost-effectively manage the control of large fires is still a major problem for the fire control organization. The business-like management of large fires is difficult to realize quickly when the major concern is the control of the fire under conditions of escalating difficulty. The fire control organization is not always geared to make the transition from the readiness to control small fires to the economic management of large and expensive fires.

   While large fires comprise only about 2% of the total number of fires, they account for some 60 to 70% of the total cost plus damage.

5. Fires started by arsonists have reached alarming proportions in the Cariboo Forest Region and have increased significantly in the Prince George and Prince Rupert Regions. In the Cariboo, such fires have increased by 50% in the last five years and account for about 23% of all fire starts. In addition, extensive areas of dead and dying forests caused by bark beetle epidemics have set the stage for catastrophic fires and rural residents are becoming concerned for their safety.

Pest Management Issues

1. The greatest pest problem currently facing the ministry is the massive and escalating bark beetle infestation that is killing pine and spruce stands in five of six forest regions. The area under attack has grown from 32,000 hectares in 1975 to 540,000 hectares in 1984. Some 59 million m³ of merchantable timber have been killed during this period, worth about $100 million in stumpage revenue and $4.8 billion in export value. No

natural population collapse is expected until the majority of susceptible pine and spruce stands have either been destroyed by the beetle or logged. Forests at risk to further attack amount to 1.1 billion m³ of wood worth over $90 billion in export value. In addition to these massive incurred and expected losses are the future costs of increased fire protection in the dead forests, the disruption of planned harvesting schedules by salvage operations (if indeed salvage is possible), and the costs of rehabilitating the area to return it to healthy forests. The infestation also adds to forest industry costs by disrupting species and log size mixes at wood manufacturing plants; and it could also necessitate reductions in allowable cuts in some managed units. Consequently, these insect attacks threaten the future economic stability of many communities.

2. Another major issue is the social and political pressures both for and against pesticide use in forestry. Most pesticide applications are in the form of herbicides used to manage undesirable vegetation. Insecticides have not been used extensively. Herbicides are used in some areas to clear out brush before tree planting operations and during the stand-establishment and tending phases to protect the new forest from competition and crowding out. Latest estimates indicate that the total provincial brush problem on good and medium growing sites amounts to 2.8 million hectares. This is land that could be growing healthy crops of trees capable of yielding about 8 million m³ of wood per year, worth some $637 million in shipment value, plus stumpage revenues of $52 million. While two-thirds of the brushed-in areas occur in the Prince George Forest Region, the greatest dollar returns for brush treatment per unit area exist in the Vancouver Region.

   Forestry is a low volume user of pesticides compared to agriculture or homes and gardens and, thus, manufacturers rarely develop chemicals specifically for forestry purposes. This limits the numbers and types of pesticides that are registered for forestry treatments. When social or political pressures limit the use of certain chemicals, such as the phenoxy herbicides, forestry practitioners have few practical alternatives.

3. Consultation and coordination between the Protection Program and the Planning, Range, Recreation, Silviculture and Timber Management Programs needs to be improved substantially. Planning staff must ensure that protection priorities and target levels are identified in each timber supply area and tree farm licence in order to improve pest management planning in a cost-effective manner. Wood losses due to forest pests will be most effectively reduced over the long term by applying subtle preventative measures throughout the cycle of a forest rotation. Timber Management and Silviculture Programs are the major avenues for taking advantage of these opportunities.

4. Forest management is being severely inhibited because the information on forest insects and diseases is insufficient to meet the complex requirements of today's resource managers; and the data being collected will not satisfy future needs. Until an information base has been compiled on each important host-pest complex, acceptable prevention and control options will be both difficult and inconsistent.

5. Most forest managers and practitioners at the field level need more training in pest management. They need to understand the extend of pest losses and the integrated methods available to minimize them. Until they have received appropriate training, a strong case can be made for more centralized control of pest management activities. This is especially true when pests erupt into catastrophic outbreaks. The ministry's decentralizing policies in the last few years, however, run counter to such control.

6. Cost-effective solutions to many pest outbreaks lie in early detection and in the ability to initiate rapid and aggressive action before the problem escalates beyond control. But the present budgeting system does not permit such emergency action. Time-consuming proposals must be made to various levels of government and this prohibits quick and economical solutions. Provisions must be made for drawing on emergency funds to cope with pest outbreaks before they get out of hand.

SILVICULTURE PROGRAM

The Silviculture Program's objectives are to restock denuded forest land and to improve the value and productivity of the forest resource. The Silviculture Branch is responsible for setting silviculture policies, standards and procedures and for undertaking a wide range of silviculture activities including reforestation, stand tending, seedling and seed production. Operational functions are implemented by the Ministry of Forests and forest licensees, frequently by contracting independent silvicultural firms.

The program has four components: basic silviculture, intensive silviculture, nursery operations and seed operations.

Functions

Basic Silviculture. The basic silviculture component of the program undertakes treatments and activities to restock the on-going, current denudation in order to maintain the productivity of the province's forest lands. The goal is to restock all accessible forest land with commercial species within three to ten years after logging depending on site productivity and location in accordance with site-specific prescriptions. Principal activities include surveying, site preparation, planting, brushing and weeding and cone collecting.

Surveys are the planning cornerstones for subsequent silvicultural activities. Assessments are made of regeneration performance, seedling survival, planting prescriptions, mineral soil exposure, ground cone counts and cone crops.

Site preparation is normally conducted by prescribed burning or mechanical means to prepare a site for natural restocking or for planting. The most recent Five-Year Program (1984-89) sets the planting goal at 130 million trees by 1988-89. Licensees do 80% of the planting.

Brushing and weeding treatments may be needed to prevent brushing-in of regeneration on relatively productive sites or on occasion to limit excessive conifer regeneration. It can be done manually or chemically.

Most seed for seedling production is colleted from selected superior trees in wild stands. Ground or aerial methods are used to obtain the cones.

Intensive Silviculture. Intensive silviculture is undertaken to improve the yield and value of the forest resource. Principal activities include juvenile spacing, fertilization, conifer release, commercial thinning, site rehabilitation and backlog planting. In addition, rehabilitation surveys are undertaken to identify short-term and long-term management requirements for watersheds. However, the most recent Five-Year Program (1984-89) has eliminated all intensive silviculture activities except for site rehabilitation and backlog planting.

Nursery Operations. Nurseries provide appropriate seedling types for those forest lands that require planting. Nursery operations are undertaken by the Ministry of Forests, private commercial growers and licensees.

Seed Operations. Seed operations include seed centre operations and seed orchards. Seed centres extract, clean, test and store seeds collected from forest trees. The Seed Centre at Duncan processes the majority of the seeds collected in the province.

Seed orchards produce high-quality and sometimes genetically upgraded seed. As of January 1984, 35 seed orchards were operating in the province; 16 are managed by Ministry staff; 11 are managed by forest companies through credits to stumpage; and 8 are privately funded. Since 1978, 17 new orchards have been established. Seed production from coastal orchards has been impressive, exceeding pre-1979 production by five times.

Developments and Initiatives

1. The ministry now requires that forest companies conduct a pre-harvesting silviculture assessment which must specify a silviculture prescription for each cut block before it is harvested. A suitable silviculture system must be designated including acceptable species, minimum and target stocking levels, acceptable regeneration delay period and a schedule for assessing the free-growing objective as defined by current silviculture policies.

2. As forest managers have become aware of the essential role of herbicides in tending and growing trees, they have made intensive efforts to have more herbicides registered for forestry use. For the same reason, training in the use of herbicides has greatly accelerated and research efforts have also increased.

3. Private production of nursery stock by licensees and commercial operators began in 1980 and has contributed significantly to reforestation over the past four years. Ministry of Forests' nurseries now produce 100 million seedlings, while private nurseries produce approximately 50 million seedlings of which approximately 7 million are for private land reforestation purposes.

To produce more seedlings in regional locations, the Ministry opened the Harrop Nursery in the Nelson Region in 1982, recently began production at the Thornhill Nursery in Terrace, and awarded tenders for commercial seedling production near Smithers.

4. The History Record System is now functioning effectively in most forest districts. This system provides a continuous record on plans, changes and accomplishments on each discrete identified unit of land. As microcomputers come on line in district offices, direct data input and recall will provide the field practitioner with an effective planning and decision-making system for silviculture practice.

5. Since the First Resource Analysis, Coastal and Interior Tree Improvement Councils have been formed comprising representatives from the ministry, forest companies and the Canadian Forestry Service. One coastal and two interior technical planning committees review seed orchard working plans and other associated tree improvement projects and offer technical input to these councils.

   A Seed Orchard Agreement, drafted in 1983, recognizes the long-term nature of seed orchards and sets terms of reference between the Ministry of Forests and the forest companies involved in seed orchard management. It is a good example of joint efforts in long-term planning and avoidance of costly duplication of effort.

Issues

The success of the Silviculture Program requires that certain issues be resolved.

1. Planting levels must continue to increase and site preparation, brushing and weeding are insufficient to attain basic silviculture levels now perceived to be necessary to sustain current levels of allowable annual cut. This is partially due to increased rates of land denudation under the Small Business Enterprise Program where the licensee is not responsible for reforestation and to the extensive harvesting of beetle-killed timber. To meet the needs, the basic silviculture program must be increased. Current estimates of basic planting requirements are 170 million seedlings annually.

   Approved program goals for basic silviculture only provide sufficient site preparation for planting some 50% of the currently denuded sites: the remaining 50% are left to regenerate naturally. Of the latter, at least 20,000 hectares annually require site preparation. As outlined in Table E-2, site preparation will be carried out on only 36% of denuded areas in 1983-84, rising to 55% in 1988-89.

Table E-2. Planting and Site Preparation Goals

Year	Estimated area denuded by clearcuts and wildfire (ha)	Goals - Planting	Goals - Basic Site Preparation
1983/84	210,000	85,700	76,600
1984/85	210,000	86,400	88,100
1985/86	210,000	91,000	93,000
1986/87	210,000	93,000	101,000
1987/88	210,000	100,300	116,400
1988/89	210,000	112,400	117,200

2. Present logging methods have reduced the area on which natural regeneration can be relied upon. For example, whole-tree extraction of pine reduced cone supply on the ground. Thus, areas logged using this method require planting. An analysis clearly shows that it is cheaper to use this harvesting method and replant than to use any other logging method that could assist natural regeneration. Large clearcuts also reduce the opportunity for natural regeneration, and this method is now used extensively for cutting spruce. It is estimated that 90 to 100% of all spruce areas require replanting. Given these circumstances, the present level of planting must continue to increase.

3. Current estimates indicate a total of 2.9 million hectares of productive forest lands (good and medium sites) are partially or completely occupied by nonforest crop vegetation. This total is expected to increase by 48 000 hectares per annum if no proper vegetation management action is taken in denuded areas. Thus, resources must be made available to enable sufficient treatments and site preparation to ensure that free-growing plantations are established. This must be backed up with a significant herbicide, site preparation and seedling research program to ensure the best combinations of site preparation, herbicides or alternate control methods and seedling stock type are realized. In the interior, much more attention must be given to mechanical site preparation as well as to 'brown and burn' techniques to achieve site preparation objectives.

   The present constraints on herbicide use have resulted in brushing-in on better growing sites in valley bottoms. Seedling growth is severely reduced and, in some cases, seedlings die from competition and reduced light. Manual brushing is costly and generally unsatisfactory because of rapid and multiple resprouting. In 1983 manual brushing cost an average of $500 per hectare for each entry with generally two or three entries being required; aerial herbicide applications cost an average of $200 per hectare with only one entry normally required.

4. Sufficient resources must be made available to ensure adequate silvicultural surveys which provide the planning cornerstones for all subsequent silviculture activities. Furthermore, as the requirement to conduct free-growing surveys comes on line, a considerable increase in survey goals and funds will be required to evaluate the growth performance of new forests.

5. Juvenile spacing and fertilization programs have been deferred. Without renewing these programs, harvest targets in some timber supply areas will not be met. In addition, they are essential for improving the unit value of timber by producing larger, more uniform trees.

6. Nursery production is insufficient to meet sowing requests which far exceed program goals. This is a particularly severe problem in the Cariboo Region where licensees have been directed to harvest beetle-killed timber, thus increasing the denudation rate.

7. It has been necessary to curtail transferring from bareroot nursery systems to container production. The latter is needed to provide more uniform stock, to improve the ability to meet production goals, to reduce costs of nursery production and planting, to improve field survival rates and plantation growth performance and to eliminate frost heaving losses. The changeover is particularly important to the interior spruce nursery program where research has shown that significant improvements can be made in plantation growth, survival and seedling physiology when container seedlings rather than bareroot seedlings are used.

8. Cold storage facilities (public and private) for seedlings in north-central B.C. are inadequate. Storage for an additional 10 million seedlings is needed over the next four years. Otherwise, the equivalent amount of stock must be planted without cold storage. That is, in the summer or early fall, making the logistics of planting more difficult.

9. An anomaly presently exists regarding licensees' basic silviculture obligations: approved management and working plans set reforestation goals that usually require more seedlings and funds than are allowed for in the Five-Year Forest and Range Resource Program. Regional offices therefore cannot allocate the required seedlings and, thus, the provisions of the management and working plans cannot be met.

10. Seed storage facilities are inadequate to assure safe seed storage and to meet future needs. A Seed Centre Planning Committee has recommended that a new facility at Surrey Nursery be constructed immediately. This facility would not only provide secure seed storage but would also include modern equipment for more effective and efficient seed processing and cleaning. The resultant higher-quality seed would increase efficiency in nursery operations through better germination rates.

11. There is some concern that the number of trained silvicultural and horticultural technicians will be insufficient to meet future silviculture needs.

CHAPTER E5

MINISTRY OF FORESTS' PROGRAMS: EXPENDITURES AND LINKAGES

The Ministry of Forests' programs were described individually in Chapter E4. Each of these programs has certain objectives which must be met to ensure that the ministry fulfills the obligations of its mandate. Effective performance of the ministry requires the appropriate mix of funding, manpower, equipment and materials integrated through the collective action of the various programs.

EXPENDITURES

Expenditures from fiscal years 1978-79 through 1983-84 are presented and salient patterns are highlighted. Because the program structure prior to the 1980-81 fiscal year is so different from subsequent years, identification of expenditures by individual program encompasses only the years 1980-81 through 1983-84.

To allow ready comparisons, the appropriate discount factors have been applied to the data from each year resulting in presentation of expenditures in constant 1984 dollars (Table E-3).

Expenditures by the Ministry of Forests have decreased between 1980-81 and 1983-84 by some 23% when adjusted to constant dollars. Each of the individual programs also sustained reductions over the period ranging from a low of 9% in the Finance and Administration program to a high of 51% in the Harvesting program.

Most of the programs maintained a fairly constant level of expenditure relative to the Ministry total during this period. The three exceptions were the Finance and Administration, Harvesting and Silviculture programs. Relative to the others, the Finance and Administration program shows an increasing proportion of expenditure from 16% of the total in 1980-81 to 20% in 1983-84. The same is true of the Silviculture program rising from 27% to 32% in 1983-84. It is the Harvesting program that has changed the most in relative terms, falling from 38% of the 1980-81 expenditures to 24% in 1983-84.

These figures reflect the impact of the recession on the forest industry. Because the industry was functioning at such low profitability, harvesting expenditures particularly in road building were curtailed to absolute minimum. This leaves a serious backlog to be overcome in the near future.

Table E-3. Annual Expenditure by Program 1978-79 to 1983-84

Program	Expenditure (thousands 1984 $) 1978-79	1979-80	1980-81	% of Total	1981-82	% of Total	1982-83	% of Total	1983-84	% of Total	% Decrease in Expenditure From Highest Year to 1983-84 Expenditure
Minister's Office			180	-	192	-	188	-	145	-	24
Management			12 012	3	13 646	4	12 607	4	11 262	4	17
Finance & Admin.			58 520	16	62 640	17	58 256	17	56 770	20	9
Harvesting			143 027	38	98 456	27	75 142	22	70 050	24	51
Silviculture			100 289	27	93 084	26	103 924	31	92 391	32	11
Research			11 351	3	10 322	3	10 224	3	8 818	3	22
Forest Protection			16 310	4	26 604	7	21 071	6	14 979	5	44
Fire Suppression			25 708	7	48 010	13	47 506	14	26 106	9	46
Range			4 123	1	5 481	2	4 898	2	4 020	2	27
Recreation			3 917	1	5 164	1	4 424	1	3 516	1	32
Total	229 743	254 367	375 437	100	363 599	100	338 240	100	288 065	100	23

The silviculture expenditures were maintained as high as possible, primarily in the area of planting, by shifting priority from other programs and thus helping to continue restocking of depleted areas.

PROGRAM LINKAGES

The following description indicates how the ministry's programs are linked internally to each other and externally to programs of other provincial ministries and national/international governments and agencies.

Only the linkages associated with those programs which have operational relationships are presented. Programs which are purely supportive, such as Finance and Administration, are not highlighted. Table E-4 shows the over-all scheme of communications linkages (internal/external) associated with these programs.

HARVESTING PROGRAM

Internal Linkages

The harvesting program is related to other Ministry programs in the following manner.

Finance & Administration: Planning, acquisition and start-up of electronic data management systems have been strongly supported by Systems Services Branch.

Research: Research Branch has developed yield estimates, site index equations and other growth and yield associated systems. Joint efforts (between Planning-Inventory and Research Branches) have resulted in development of of forest planning models, as well as provision of advice regarding use of the ecological classification system.

Silviculture: There is a close liaison between the Planning and Inventory and Silviculture Branches regarding mapping descriptions and associated statistics for openings. Also TSA/TFL plans identify the silvicultural strategies required to meet future production targets. Engineering Branch cooperates with Silviculture Branch in the areas of equipment development and acquisition of land for silvicultural operations (i.e. nurseries).

Forest Protection: On-line access to the forest inventory data base aids in determination of fire hazard rating and estimates of forest values which may be threatened by fire or pests. Further, there is the possibility that forest inventory techniques can be used for detection, mapping and storage of pest-related attacks and damage. Harvesting priorities/constraints are influenced by pest problems, as are future yield opportunities. TSA/TFL plans establish (through cooperative efforts) fire management priorities.

Range: Range production targets are incorporated into TSA plans. Planning and Inventory Branch develops, maintains and provides range use statistics. Two notable examples of this are range area and production reports and the incorporation of range administration boundaries into the forest area data base.

Table E-4 Ministry of Forests Program Linkages

	Ministry Program	Harvesting	Silviculture	Research	Forest Prot/ Fire Supp	Range	Recreation
External Linkages	Academic Institutions			x		x	
	Private Sector	x	x	x		x	
	National/International	x				x	
	Government of Canada	x	x	x		x	
	Workers' Compensation Board				x		
	Other Agencies			x	x	x	
	Ministry of Provincial Secretary						x
	Ministry of Labour				x		
	Ministry of Finance				x		
	Ministry of Health				x		x
	Ministry of Municipal Affairs				x	x	x
	Ministry of Industry & Small Business Development	x					
	Ministry of Energy, Mines & Petroleum Resources	x					x
	Ministry of Agriculture & Food	x			x	x	
	Ministry of Transportation & Highways	x				x	x
	Ministry of Universities, Science & Technology	x			x		
	Ministry of Lands, Parks & Housing	x			x	x	x
	Ministry of Environment	x		x	x	x	x
Internal Linkages	Recreation	x	x	x	x	x	
	Range	x		x	x		
	Forest Protection/Fire Supression	x	x	x		x	x
	Research	x	x		x	x	x
	Silviculture	x		x	x	x	x
	Harvesting		x	x	x	x	x
	Finance & Administration	x			x	x	
	Management				x		

Recreation: Through joint effort recreation goals are incorporated into TSA/TFL plans. Planning-Inventory Branch provides forest area maps and statistics to supplement recreation resource inventories, as well as designating environmentally sensitive areas with recreation potential.

The harvesting program also relates to other programs which are external to the Ministry of Forests.

External Linkages

Ministries of Environment and Lands, Parks and Housing: Computer assisted mapping technology requires cooperation between the three ministries. Sharing of compatible digital data bases is proving to be an efficient cost-effective means of producing digital, planimetric, cadastral and status detail for the province. Inventory data is used by the Terrestrial Studies and Fisheries and Wildlife Branches of the Ministry of Environment. Further, there is a coordination of fish and wildlife and water resource management requirements with those of forestry. Engineering Branch cooperates with the Water Management and Fisheries and Wildlife Branches in the Ministry of Environment to establish procedures for stream crossings and design of roads running adjacent to streams. There is also a cooperative effort regarding allocation of Crown land, outside Provincial Forests, to various uses through Crown land plans and deferred planning area reviews. Timber Management Branch coordinates deletion of Crown lands from Provincial Forests and maintains a land status information system.

Ministry of Universities, Science and Communications: There is a transfer of technology from the Harvesting Program to the private sector through the B.C. Science Council.

Ministry of Transportation & Highways: There are cooperative agreements with Engineering Branch regarding construction and maintenance of Forest Service roads and intersections of the same with public roads and railways.

Ministry of Agriculture and Food: There is a cooperative effort to assess Crown land for its agricultural capabilities and integrate agricultural requirements with forest management.

Ministry of Energy, Mines and Petroleum Resources: An effort is made to integrate mineral resource extraction with forest management and coordinate access development.

Ministry of Industry and Small Business Development: There is a cooperative effort in resource development studies such as Northeast Coal infrastructure; B.C. Rail - Dease Lake Extension Feasibility; and Mt. Klappan Northwest Transportation.

Government of Canada: Coordination of anadromous fishery management with Ministry of Forests programs, as well as exchange of information and support of national forest statistics, remote sensing and mapping technology and national biomass programs is undertaken. Through the Timber Management Branch there is liaison with such federal departments as Indian and Northern Affairs and Fisheries and Oceans regarding timber harvesting.

Private Sector: Active encouragement of private sector involvement in the production of forest cover maps and technological developments is promoted. Also, lines of communication between this program (via Timber Management Branch) and various associations which represents the interests of the private sector (i.e. Council of Forest Industries, Interior Lumber Manufacturers Association, and Truck Loggers Association, to name a few) are maintained. This linkage is often strengthened through joint participation on committees such as the Small Business Enterprise and Logging Contracter Advisory committees.

National/International: There is participation in activities of committees such as the committee on standards of measure and data sharing (COSMADS) and the Canadian advisory committee on remote sensing (CACRS).

SILVICULTURE PROGRAM

Internal Linkages

The silviculture program is related to other Ministry programs in the following manner.

Harvesting: The history record system provides a continuous update for various harvesting program plans in terms of activities completed on discrete openings. Also, basic silviculture activities influence TSA yield analyses and determination of the allowable annual cut.

Research: The pre-harvesting silvicultural assessment recommends silvicultural prescriptions based upon ecological classification.

Forest Protection: There is cooperation and transfer of advice regarding herbicide spray applications and aerial applications of fertilizer.

External Linkages

Private Sector and Government of Canada: There is a cooperative effort with the private sector to determine seedling production levels which should be associated with private nurseries. Also, joint committees (involving the private sector and government of Canada) such as the Interior and Coastal Tree Improvement Councils have been established to review the operations of seed orchards. The federal government also supports the silviculture program through such vehicles as the Intensive Forest Management Subsidiary Agreement (IFMSA) and employment assistance programs such as EBAP, (Employment Bridging Assistance Program), NEED (New Employment Expansion and Development) and Canada Works.

RESEARCH PROGRAM

Internal Linkages

The research program is related to other Ministry programs in the following manner.

Harvesting: 13% of the active experimental projects conducted within the research program are directed towards harvesting-related topics. Policy regarding growth and yield is also jointly developed.

Silviculture: 76% of all active experimental projects deal with silvicultural topics. There are also joint policies regarding such topics as site degradation and ecological reserves.

All Other Programs: Research cooperates with all programs in the areas of technology transfer and determination of management prescriptions. Some examples of technology transfer involve TSA analysis and inventory update within the harvesting program, site treatment prescriptions within the silviculture program and pest impact information within the forest protection program. In the area of management prescriptions research has established demonstration areas for winter range habitat in managed stands for wildlife and provides continuing education for field staff regarding characterization, description and interpretation of ecosystems.

The research program also relates to other programs which are external to the Ministry of Forests.

External Linkages

Ministry of Environment: Cooperative ventures to determine the most mutually beneficial interactions of harvesting and wildlife are undertaken, as well as those which generally detail the effects of harvesting on the environment. An example of the cooperative approach are the old growth/wildlife winter habitat studies.

Government of Canada and Other Agencies: Cooperative studies of the effects of harvesting on the environment are conducted, and program representatives sit on committees concerned with, for example, herbicide and intensive forestry practice research. The Forest Engineering Research Institute of Canada (FERIC) is also a party to those studies which assess the effects of harvesting on the environment.

Academic Institutions: The resident academic expertise at the universities is used to augment research program capabilities.

Private Sector: Licensees are allowed credits against stumpage applied to Crown lands when pre-approved research which is intended to solve technical problems or define new opportunities for meeting approved management objectives is conducted.

FOREST PROTECTION/FIRE SUPPRESSION PROGRAMS

Internal Linkages

The forest protection/fire suppression programs are related to other Ministry programs in the following manner.

Management: Information Services Branch provides an invaluable communication link between the forest protection/fire suppression programs and the public regarding fire and pest information.

Finance and Administration: This program provides to the forest protection/fire suppression programs radio communication systems required in fire control operations. As the result of a cooperative effort an equipment inventory and stocking levels management system will be implemented to ensure the most cost-effective use and movement of fire-fighting equipment. The finance and administration program is also cooperatively involved in project management for air tanker base development.

Harvesting: By preventing or reducing fire/pest losses the forest protection/fire suppression programs make more wood available to the forest industry.

Silviculture: This program safeguards the heavy investment in plantations through fire and pest protection services. There is also a cooperative approach to juvenile spacing activities to ensure that slash and the attendant fire hazard is reduced and that the spread of dwarf mistletoe resulting from increased light due to spacing is minimized. Advice regarding use of prescribed burning for site preparation is also given. Through its representative on the B.C. Pesticide Control Committee the Forest Protection program supports vegetation control activities in plantations, nurseries and seed orchards. Pesticide application training services are also offered to silviculture personnel. Joint determination of the most cost-effective use of aircraft for activities such as aerial fertilizer application and cone collection is also undertaken.

Research: Cooperative projects are undertaken such as the Northern Fire Ecology Study, development of field measurement standards for collection of prescribed burn data, environmental impacts of prescribed burns, use and impact of herbicides, the effects of fire and pests on whole forest yields, and the establishment of the lightening location network.

Range: The range management investment (forage, fences and so on) is protected from fires and pests. Consultative services regarding control of undesirable plant species (such as knapweed) are also provided by the forest protection program.

The research program also relates to other programs which are external to the Ministry of Forests.

External Linkages

Ministry of Environment: There is a protocol agreement with the Wildlife Branch regarding use of prescribed burning for wildlife habitat improvement. A program representative also sits on the Pesticide Control committee. The forest protection/fire suppression program is involved in the Provincial Emergency Program in development of evacuation plans and responsibilities in the event that a fire or other disaster threatens a community. Air Studies Branch of the Ministry of Environment and this program jointly analyse the effects of prescribed fires on pollution and the impact of the smoke management program.

Ministry of Agriculture and Food: Each ministry holds a position on the B.C. Advisory Pest Control Commission and coordinates Federal/Provincial activities combatting pest outbreaks.

Ministry of Municipal Affairs: This program offers advice regarding management of garbage dumps for wildfire risk and pest problems on private lands. Advice pertaining to the risk of wildfires associated with the encroachment of housing developments on the forest is also offered.

Ministry of Lands, Parks and Housing: A cooperative effort regarding fire control in provincial parks and ecological reserves is undertaken.

Ministry of Labour: The Ministry of Labour has supported achievement of forest protection goals through enhanced employment opportunity programs directed principally at fire suppression and pest survey activities.

Ministry of Health: There is a cooperative effort dealing with the health aspects of smoke and pest management.

Ministry of Finance: There is a special relationship due to the extensive purchase of fire-fighting tools and equipment from the Purchasing Commission.

Ministry of Universities, Science and Communications: Prior to 1984 this ministry paid for the communications costs associated with the lightening location system and the toll free fire reporting telephone number.

Workers Compensation Board: There is a cooperative program regarding maintenance of safety requirements under emergency fire conditions in effect. Also, new techniques in fire control, such as exploding detonating cord developed to establish fire lines and the helicopter rappelling system for fire and pest initial attack, are reviewed by the board prior to implementation.

Other Agencies: Fire control agreements clarifying roles and responsibilities for each of the parties are maintained with all Canadian provinces and territories through the Canadian Interagency Forest Fire Centre at Winnipeg.

There are also agreements with the U.S. Forest Service, Alaska, Washington State, Idaho and Montana, as well as the Government of Canada through the Canadian Forest Service and Department of Indian Affairs, B.C. Hydro and Power Authority and British Columbia's municipalities.

RANGE PROGRAM

Internal Linkages

The range program is related to other Ministry programs in the following manner.

Finance and Adminstration: Planning, design and implementation of the Range Improvement and Range Tenure Systems has been conducted in coordination with Systems Services Branch.

Harvesting: Range management staff review TFL management and working plans for range management content (such as forage production and livestock management plans in forested rangelands) prior to their approval. Planning and Inventory Branch is responsible for developing, maintaining and providing range resource statistics, such as range area and production reports.

Silviculture: There is a cooperative effort involving determination of appropriate treatments for required regeneration of forested sites for both woodfibre and range production.

Research: There is a cooperative effort directed toward researching topics and projects which Range Management Branch has initiated to meet management requirements.

Forest Protection: There is a cooperative effort regarding design and control of prescribed burning of rangelands as a means of enhancing forage production. This program also offers advice regarding biological control of unwanted vegetation such as knapweed.

Recreation: The range and recreation programs cooperate regarding recreational use of forested and non-forested range lands.

The range program also relates to other programs which are external to the Ministry of Forests.

External Linkages

Ministry of Agriculture and Food: Range improvements are facilitated through the ARDSA Agreement between the Ministry of Agriculture and Food and Agriculture Canada. There is also communication regarding coordinated resource management planning. Furthermore, there is frequent interaction concerning grazing livestock management of Crown range and related issues such as range allocation, as well as general exchange of knowledge. As the lead agency in the Knapweed Action Committee, the Ministry of Agriculture and Food is a prime source of information for Range Management Branch.

Ministry of Environment: The primary interaction with Range Management Branch is regarding wildlife forage and habitat management. There is a further line of communication developed through the coordinated resource management planning process (CRMP).

Ministry of Lands, Parks and Housing: The Range Program maintains communications regarding decisions on whether or not grazing leases should be implemented, or whether Crown range under these leases should be allocated to grazing permits and licences. There is also a cooperative effort maintained regarding management of Deferred Planning Areas (DPAs). Finally, there is a line of communication extended through mutual involvement in the coordinated resource management planning process.

Ministry of Municipal Affairs: There are informal arrangements to deal with expansion of residential developments into rangeland areas.

Ministry of Transportation and Highways: There are lines of communication opened regarding fencing of highways and the effects on range management of the consequent compartmentalization of the land.

Government of Canada: There are important historical and current linkages with Agriculture Canada, such as exchange of research information and involvement in biological control programs for the eradication of knapweed. Also, the range program is responsible for managing range that is controlled by the federal government through the Department of National Defense.

Academic Institutions: Important research, education and extension linkages exist between the range program and academic institutions.

Private Sector: There are important linkages with the livestock associations and the B.C. Cattlemen's Association regarding issues related to management of Crown rangelands. Also, there is a line of communication with the B.C. Wildlife Federation regarding livestock/wildlife conflicts.

Other Agencies: There is a communication with the B.C. Forest Research Council regarding the state of research activities related to range management.

National/International: There is a dialogue with the U.S. Forest Service regarding various topics in range management.

RECREATION PROGRAM

Internal Linkages

The recreation program is related to other Ministry programs in the following manner.

Harvesting: There is a cooperative approach to integrating recreation management objectives with timber extraction and valuation in effect. Also, all planning procedures pertaining to recreation were developed in consultation with the Planning and Inventory Branch.

Silviculture: There is a cooperative effort to expand the utility of the pre-harvest assessment system to include integrated management considerations as they pertain to recreational values.

Research: Research Branch provides expertise in sampling design to facilitate recreation activities such as user demand studies.

Forest Protection: Pest management specialists assist this program by identifying hazard situations on developed sites and trails.

The recreation program also relates to other programs which are external to the Ministry of Forests.

External Linkages

Ministry of Lands, Parks and Housing: A protocol agreement regarding respective recreation roles of the two ministries is in effect and close liaison is maintained. Also, the use of All Terrain Vehicles as they impact upon Crown lands is cooperatively managed. And finally, there is a cooperative agreement regarding leases or licences for commercial recreation operations and related tenures and recreation cabin permits.

Ministry of Environment: The interaction between fish and wildlife and recreational values is cooperatively managed.

Ministry of Transportation and Highways: Liaison is maintained regarding the highway rest stop, landscaping and avalanche control programs of this ministry as they impact upon the recreation program.

Ministry of Provincial Secretary: Designation of heritage sites as an impact on the recreational resource is jointly managed.

Ministry of Health: There is a cooperative effort to ensure that recreation sites conform to established health standards.

Ministry of Municipal Affairs: Liaison regarding encroachment of communities on the forest environment takes place.

Ministry of Energy, Mines and Petroleum Resources: Liaison regarding mineral exploration in areas of high recreational values takes place.

Ministry of Municipal Affairs. There are informal arrangements to deal with expansion of residential development into rangeland areas.

Ministry of Transportation and Highways. There are times of [illegible]

[illegible]

Private Sector. [illegible]

[illegible]

Internal Linkages

The recreation program is related to other [illegible] programs in the following manner.

Harvesting. [illegible] management objectives [illegible] all planning [illegible] consultation with the Planning and [illegible] Branch.

Silviculture. There is a [illegible] effort to expand the utility of the pre-harvest assessment system to [illegible] management considerations as they pertain to recreational values.

Research. Research Branch provides expertise in [illegible] design to facilitate recreation activities such as [illegible]

Forest Protection. Pest management [illegible] assist this program by identifying hazard situations on developed sites and trails.

The recreation program also relates to other programs which are external to the Ministry of Forests.

SECTION F

INTEGRATED RESOURCE MANAGEMENT AND ENVIRONMENTAL PROTECTION

The 1978 forest legislation instructs the Ministry of Forests to plan and manage the Crown forest and range resources on an integrated resource use basis and to choose the resource mix that will ensure the maximum overall benefit. This requires that all ministries' resource programs be coordinated.

In this section the integration process will be analyzed and recent performance assessed. In addition, areas where program interactions are expected to be most significant over the next two decades will be highlighted.

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CHAPTER F1

CONCEPTS OF INTEGRATED USE

Integrated use in this section includes all interests in forest land whether they are compatible with timber production or require heavy logging constraints. It can be defined as "The deliberate and careful planning of the integration of various resource uses, to interfere with each other as little as possible and to compliment each other as much as possible, with due regard for this order of importance in the public interest in each management area, in order to achieve the optimum social and economic benefit to the people of British Columbia".

Integrated use involves the diverse program objectives of the three mandates within the Ministry of Forests: timber, range and recreation, as well as those of other resource agencies. Somehow, forest land must be managed to yield the optimum blend of all these uses. In determining that blend, the dominant position of timber harvesting has been a major consideration. It not only has immense economic importance to British Columbia, but also governs the suitability of forest land for other uses. Furthermore, the Ministry of Forests has the dominant decision-making authority, and is responsible for deciding if, when and how the effects of the forest industry on other resources are to be mitigated.

British Columbia faces increasing public pressure to establish wilderness areas, which usually impose a total prohibition on timber harvesting and, as such, may appear to be contrary to integrated use. In fact, they may support many activities including grazing, trapping, guiding and outfitting, and more. What is important is not whether integrated use is practiced, but rather, whether the land-use allocation and management practices attain the maximum level of resource production in relation to the priorities placed on the various resource sectors. The challenge is to properly establish what those priorities should be. Once they are established, the difficult task of assigning appropriate zoning and management prescriptions becomes more manageable.

Because the generalized mandates of resource agencies, including the Ministry of Forests, do not provide a clear basis for decisions, tradeoffs must frequently be negotiated. Consequently, the planning process must provide means for resolving conflicts and producing optimal allocations. The following chapter discusses the primary mechanisms for liaison between the Ministry of Forests and other resource agencies.

CHAPTER F2

MECHANISMS FOR PROGRAM COORDINATION AND INTEGRATION

Resources are managed by a number of ministries, each of which is responsible for developing and implementing its own programs in accordance with its legislated mandate. To ensure that optimum benefits result, the resource management programs from all agencies must be integrated before and during implementation. Even with the best of cooperative intentions this will be a demanding and time consuming task.

Various mechanisms are currently in place that provide a forum for this needed coordination and integration. This chapter summarizes these mechanisms, discusses their effectiveness and offers some recommendations on how to make them more effective.

The Environment and Land Use Committee (ELUC), which is part of the Cabinet Committee System, provides the highest level of resource program coordination. Below that are nine formal coordinating mechanisms between the Ministry of Forests and other provincial and federal resource agencies. In addition, informal contracts between resource agencies on a day-to-day basis provide an invaluable contribution to policy and program coordination. Somewhat more formal liaison occurs through multidisciplinary seminars and workshops held periodically to address a particular coordination need or to update one another on their progress in implementing a policy or program. Participants include senior officials and technical staff from all levels. Whether these group sessions result in recommendations for policy development or other specific actions or whether they just improve interagency understanding, they facilitate cooperation and coordination between resource agencies.

Formal mechanisms are described below along with an assessment of their effectiveness. An objective evaluation is difficult because of the Ministry of Forests' interest in the results. Nonetheless, we assess them as objectively as possible, basing some of our judgments on opinions received from other agencies and from a private consultant commissioned to review the processes.

FUNCTIONAL GROUPS

ENVIRONMENT AND LAND USE TECHNICAL COMMITTEE

The Environment and Land Use Technical Committee (ELUTC) is responsible for ensuring that all land and resource use planning programs of the provincial government, Crown corporations and local governments are coordinated in defining and achieving social, economic and environmental objectives. The ELUTC acts on the directives of the ELUC, advises that Committee and directs the work of interministry task groups.

In doing so, the ELUTC is responsible for integrated land and resource use policy planning, project impact assessment, land use conflict resolution, and developing and implementing procedures for administering the above.

The ELUTC consists of core members, associate members and consultative members. Core members have official status under The Environment and Land Use Act regulation. They include Deputy Ministers of Agriculture and Food; Energy, Mines & Petroleum Resources; Forests; Industry and Small Business Development; Environment; Lands, Parks and Housing; Municipal Affairs; Transportation and Highways; and Intergovernment Relations. Associate members have no formal status but receive agenda and minutes. They include Deputy Ministers of Health and Tourism. Consultative members have no formal status, and do not receive agenda and minutes. They include British Columbia Hydro and Power Authority, British Columbia Railway, British Columbia Development Corporation, other Crown Corporations as appropriate, and Islands Trust.

The core group meets frequently; others attend as needed at the invitation of the Chairman or at their request.

From the Ministry of Forests' viewpoint, the Environment and Land Use Technical Committee functions quite effectively, but it could increase its overall effectiveness for developing broad integrated land and resource use policies and priorities at the provincial and regional levels. This would allow all the other mechanisms discussed in this report to function more effectively and efficiently and this, in turn, would reduce the number of decisions required by the ELUTC and would make remaining decisions less difficult.

INTERMINISTERIAL COMMITTEES

Interministerial committees, made up of representatives from various agencies, address specific areas of policy development, project approval, program development and implementation. Members must have the authority to strongly influence the development and implementation of their respective policies and programs, and to direct their staff to address real or potential resource management problems at the field level. These groups, some of which are sponsored by the Ministry of Forests and some by other agencies, are established at both the provincial and regional levels.

At the provincial level, several interdisciplinary commissions, boards, councils, committees, subcommittees and task groups are operating. Some of these groups have been established to perform an ongoing statutory function, others to perform an informal liaison function and still others to address a special problem. They provide a forum for coordinating specific resource agency programs and policies including those of the federal government. Some examples include the Insect Control Board, the Forage Crops Advisory Council, the Interministerial Pesticide Committee, the Canadian Committee on Forest Fire Control, the Integrated Field Program Committee, the Recreation and Wildlife Committee, the Nanaimo Estuary Log and Fish Habitat Committee, and the Energy Project Review Committee.

Interministerial committees at the provincial level have been quite effective for coordinating specific areas of policy interactions. They do not, however, span the gamut of resource use issues and much remains to be resolved by other means.

At the regional level, several committees, subcommittees and task groups have been established to coordinate various aspects of resource management. Participation depends on the purpose of the group. The majority of these groups are sanctioned by, and report to, regional officials of one or more provincial ministries. The Ministry of Forests also participates on committees established by other resource agencies or levels of government to facilitate interagency coordination. Some examples of these types of groups include Local Land Use Planning Committees (e.g. committees working on Coordinated Resource Management Plans and Deferred Planning Areas); District Insect and Disease Control Committees; Recreation Project Committees; Committees for the Control/Management of Weeds, Fire Prevention, Community Pastures, etc.; Special Advisory Committees; and Community Pasture Management Committees.

PROCESSES

In addition to the Forest and Range Resource Analysis and associated components of the Management system (described in Section A), the Ministry of Forests uses a number of other methods to coordinate its program with those of other resource agencies.

It is just beginning to implement formalized strategic plans through the Forest Management Planning Process. This process recognizes two strategic planning units: the timber supply area (TSA) and the tree farm licence (TFL). TSA Plans and the TFL Management and Working Plans, which contain long-term objectives and strategies for managing timber, range and recreation resources, also state the provisions the Ministry of Forests is making for other resource agency programs. The TSA Plan and the TFL management and working plans are prepared at roughly the same level of detail as the strategic plans of other ministries, (e.g. Subregional Crown Land Plans and Subregional Strategic Plans (Ministry of Environment)).

Procedures are in place for each resource agency to state its own management objective for the TSA or TFL, although they are viewed by other agencies as giving insufficient priority in non-timber uses. The general public also has an opportunity to become involved. This multidisciplinary approach to identifying objectives early in the process facilitates the subsequent design and description of management options for timber, range and recreation. The intent is to negotiate a plan that achieves an optimal balance between overall resource production levels and allocation among various user interests. The Ministry then determines the best plan for the managed unit.
Various kinds of resource management plans are prepared at the local level. These include Resource Folios, Subunit Plans and Coordinated Resource Management Plans. They cover part of a timber supply area or tree farm licence and are operational in nature unlike forest management plans, which are strategic in nature.

To date the local planning process, where implemented, has been a reasonably effective mechanism for coordination. This is particularly true in the case of Coordinated Resource Management Plans. However, the effectiveness of local planning is frequently affected by the lack of overall policy direction and approved strategic plans, the lack of clear and complete terms of reference and an imbalance in the amount and quality of inventory information available for the different resources. Another critical problem currently affecting the success of local planning is that in many cases other resource agencies have not allocated the human or financial resources to effectively participate in the process. Local officials also pointed out that coordinated resource management planning is effective when used to coordinate operational actions in areas where land-use decisions have previously been taken. However, it is not a suitable vehicle for making those land allocation decisions. Nonetheless, in some areas, it is being used for that purpose in the absence of a more appropriate process.

Other resource agencies also have local planning processes designed to resolve resource and land use conflicts. These may be effective once implemented, but inefficiencies arise because no procedures are in place for deciding which agency should take the initiative or which process should be used.

Developmental proposals for timber, range and recreation are referred to other agencies for comment before being approved. This provides an opportunity to identify where potential program conflict could arise and what measures could be taken to avoid that conflict. Referrals are typically made to the Ministry of Environment, the Ministry of Lands, Parks and Housing, the Department of Fisheries and Oceans and local governments.

These provide a final opportunity to coordinate specific management activities of the various resource agencies. Currently, this approach is working reasonably well, but some field staff in the Ministry of Agriculture and Food feel that the interfaces through joint field inspections in areas of mutual interest could be strengthened.

Joint field inspections with staff from other agencies often result from referrals. Such referrals provide a useful tool for coordinating program activities: they allow the other agencies to either request changes to accommodate their programs, to modify their own programs to be compatible with the proposals, or both. However, if numerous referrals are made all at once, the turnaround time for a given proposal can be unacceptably long. Effectiveness also depends on the existence of higher-level plans to guide the decisions made as a result of the referral. At least one agency suggested that the referral of Ministry of Forests plans have been quite effective, but the referral of proposed policy changes have been ineffective because interagency consultation was handled poorly.

Undoubtedly, strategic planning could provide a good opportunity for rationalizing and coordinating management objectives. Currently, however, this opportunity is not being fully exploited. The Ministry of Forests recognizes that the degree of consultation carried out with other agencies on TSA and TFL planning is sometimes inconsistent among forest districts and regions. In addition, because formal strategic planning is relatively new to resource agencies, most have not developed the processes to the point where interagency integration can be effectively addressed. Even when the procedures are in place, it is difficult to see how the necessary tradeoffs and compromises will be attained as long as each agency pursues its own mandate, which emphasizes only one part of the overall resource picture.

CHAPTER F3

POTENTIAL CONFLICTS WITH OTHER RESOURCE PROGRAMS

Provincial Forests, now established throughout the province, provide a geographical distinction between lands best suited to forest uses and those best suited to nonforest uses. This has effectively allocated lands between forest and nonforest uses, but conflicts related to the use of Provincial Forest lands still arise. One of the major factors contributing to this situation is the absence, in many cases, of clearly understood goals and resource use priorities for resource management as intended by government for the various regions of the province. In this chapter, potential program interactions of provincial scope are discussed. There will be variations among regions in both occurrence and extent due to differences in biological relationships and resource use demands. Of all the perceived potential conflicts those which will have the most significance and require the most careful tradeoffs are those involving alienation of productive land, and resource interaction between timber and fish, wildlife and water. In these, the Ministry of Forests will interact with the Ministry of Lands, Parks and Housing and the Ministry of Environment.

TIMBER AND WATER INTERACTIONS

The Ministry of Environment's Water Management Program is responsible for managing the provincial water resources. Its goal is to maximize the contribution these resources make to the social and economic development and well-being of all British Columbians.

Forest harvesting and associated activities can have profound effects on water resources. They can cause degradation of water quality, alterations to flow regime, flooding and erosion.

Sediment from timber harvesting operations, particularly logging roads, and pollutants from timber processing industries can affect the quality of water and thus its suitability for consumptive and nonconsumptive uses. Pollutants are under the direct control of the Ministry of Environment through the waste management permitting process. Sediment loadings affect domestic water sources in many areas of the southern interior and fish resources throughout the province. They are not, however, regulated through permits because they arise from "non-point sources". Increases in steep-slope logging can be expected to further aggravate the situation by exposing erosion-prone soils.

Vegetation removal and landscape changes due to forest harvesting can affect both the timing and the magnitude of discharges from a watershed. These changes are dependent on factors such as watershed size, the existing flow regime, the extent of vegetation removal and the type of forest harvesting practices. It is clear that the effect on water supplies can range from detrimental to beneficial. Joint planning efforts are required to quantify these interactions and to capitalize on the water management opportunities afforded by forest harvesting.

Forest harvesting activities have been a contributing factor to log jams, debris torrents and downstream depositions, all of which precipitate flooding, erosion damage and stream channel alterations. Though identifying environmentally sensitive areas has partially addressed the problem, more attention could be paid to geological processes and terrain hazards in deciding whether a forest stand should be cut and, if so, what silvicultural system and logging techniques are most appropriate. Once again the solution lies in cooperative planning between environment and forest managers, and a true willingness to select harvesting and water management options that are applicable to local site conditions. Even with this, however, atypical catastrophic weather situations can negate the best plans.

Other conflicts can arise from measures taken to protect or manage the water resource that reduce the total wood volume available for harvest from a given watershed, such as permanent buffer strips of timber left along streams or lakes to protect water quality. In addition, protracted harvests in a given watershed required for protecting water quality and flow regime can reduce harvestable volumes in the long term due to natural mortality, reduced operational flexibility and increased operational costs.

Resource conflicts such as those described above can be addressed through changing resource allocation (e.g. reserving timber, deferring harvesting, securing alternative sources of water, or deciding to allow water quality to fall below a level acceptable for existing uses), through modifying management practices (e.g. changing silvicultural systems and forest harvesting techniques or applying a higher degree of water treatment), or both. Which course is most appropriate will depend on local circumstances.

Every forest region has some potential for conflict between timber harvesting and water management. However, in the future, effective cooperative planning efforts must be priorized and directed to areas of most significant potential conflict. The following information will be needed to determine planning priorities:

- proposed harvesting schedule;
- number and type of water licences;
- presence of community watersheds; and
- terrain and soil complexity, presence of potentially unstable materials and environmental hazards.

TIMBER AND HYDROELECTRIC DEVELOPMENT INTERACTIONS

Much of British Columbia's supply of electricity comes from hydroelectric developments. These affect forest management primarily by alienating productive forest land through flooding and through constructing transmission rights-of-way. This can result in a reduced long-run sustainable timber yield accompanied by reduced forestry revenues and employment. The lands involved usually have high productivity and would be the target for intensive forest management. Thus, their loss has greater significance than normal.

Two hydroelectric options for increasing power supply in the Prince Rupert Coast Region are the Stikine-Iskut development and Alcan's Kemano Completion Project. The Stikine-Iskut development consists of four projects. The reservoir would require 22,000 hectares of forest land of which 19,400 hectares is productive forest. The transmission lines may affect a further 1.9 million m^3 of timber depending on route selection. The Kemano Completion Project would involve flooding the Nanika and Kidprice Lakes area 95 km southwest of Houston. Forest land loss would be approximately 1,800 hectares of which 1,140 is productive forest. But the majority of this is inaccessible or designated as an environmental protection area.

When hydroelectric projects are proposed, alternatives must be carefully weighed in terms of their social, economic and environmental implications and the final decision must reflect a balanced assessment of these factors.

TIMBER AND FISHERIES INTERACTIONS

The fisheries management program undertakes to protect and maintain healthy aquatic environments and fish populations and to rehabilitate those now degraded. Its goal is to assure continued supplies of fish and fishing opportunities that will contribute to society's needs for recreational activity, wholesome food, employment and income and a high-quality environment.

Through interagency planning and consultation, resolving resource use conflicts, enforcing pertinent legislation and controlling the import of live fish and aquatic invertebrates, the program strives to protect fresh water fish and their habitats from degradation or loss. It also endeavours to increase fish production through improving existing fish habitat, replacing or repairing lost or degraded habitat, operating and maintaining existing protection and production facilities, and controlling or eradicating undesirable populations of fish in specific waters.

Both the timber and the fisheries resource support large and important industries. The most significant interactions between forest harvesting and associated activities and fisheries management relate to effects of harvesting on the productivity of aquatic systems and recreational values. Some of the adverse effects can be the degradation of water quality and changes in flow regime, the destruction of fish habitat and the proliferation of road access.

Forest harvesting activities, if not planned carefully, can lead to fish habitat destruction through the removal of streamside vegetation, debris deposits in water courses and stream channel alterations. Detailed information on the impact of water-borne contaminants is lacking but enough is known to warrant caution in water-quality management. As with other water uses, changes in discharge regime and temperature due to forest harvesting can enhance or reduce fish production depending upon local circumstances.

Increased road access associated with forest harvesting increases the fishing pressure on sensitive fish populations, detracts from the wilderness quality and makes fishing regulations more difficult and costly to enforce. On the other hand, road access has enhanced many sport fishing opportunities.

Frequently, timber harvesting must be deferred to protect the integrity of fish habitat. Usually, these areas have a high tree-growing capability and thus deferral for up to 20 years can have a significant impact on forestry programs. This can result in a reduced short-term timber supply, volume losses due to natural mortality during the deferral period and increased harvesting costs due to the need to shift operations to more isolated areas. It also increases the need to operate on steeper terrain and in poor quality stands, and the need for additional roads, smaller cutting areas and special equipment.

Conflicts between fish and timber management can be resolved in the same way as described for water. That is, through changing resource allocation (e.g. reserving timber in buffer zones and unstable areas, changing the cut rate, accepting fisheries losses in certain systems), through modifying management practices (e.g. changing silvicultural systems and forest harvesting techniques, designing more appropriate surface drainage control and stream crossings on road systems, mitigating losses and long-term access management through fisheries enhancement), or both. The most appropriate option will depend on local conditions.

From a fisheries management perspective, the following information will be needed to determine planning priorities:

- proposed harvesting schedule;
- presence of Class 1 (priority) fish streams in the next 10 years of operational logging plans,and fish populations (actual and potential
- terrain and soil complexity, presence of potentially unstable materials and environmental hazards; and
- construction of significant new access to lakes and streams with important fish populations.

TIMBER AND PARKS, RECREATION AREAS, ECOLOGICAL RESERVES INTERACTIONS

Parks and ecological reserves preclude timber harvesting and therefore primarily are a land allocation rather than an integrated use issue.

The direct impact of new parks and ecological reserves on timber supplies is directly related to the amount of productive forest land involved. Recreation areas do not necessarily preclude timber harvesting, but they severely constrain the volumes harvested and the harvesting schedule. In these areas, the effect on timber supplies would depend on the harvest volume and schedule deemed to be compatible with recreational objectives. Allocating productive forest land for any of these purposes could result in (1) higher logging costs due to forest companies having to move into more isolated areas and poorer quality stands, (2) exacerbation of problems in age-class structure, and (3) problems associated with industrial roads being used to transport both timber and recreationists.

The visual aesthetics in the areas adjacent to park boundaries are a significant issue in integrating timber and park values. The Ministry of Forests is often under pressure to constrain logging on these lands to enhance values within the park boundaries. The management of forest lands adjacent to ecological reserves also requires special attention.

TIMBER AND WILDLIFE INTERACTIONS

The goals of the wildlife management program of the Ministry of Environment are: (1) to maintain the diversity and self-sustaining ability of species represented in the major biophysical zones of the province, and (2) to ensure that within the constraints of land capability and the biological limits of each species, wildlife is sufficiently abundant to meet the social, recreational, ecological and economic needs of society.

Timber management activities have a significant impact on wildlife resources through their effect on vegetation patterns and access development. These impacts vary from potentially beneficial to detrimental depending on the species and the biophysical zone in which the logging takes place.

In assessing impacts, a distinction should be made between "successional" and "climax" wildlife species. Successional species such as moose, deer and elk satisfy a large proportion of their habitat needs within the pioneer plant communities that appear after a disturbance such as wildfire or logging. They are highly opportunistic and readily adapt to these transitory vegetation types. These animals have a high reproductive rate, pioneering dispersal behaviour and a tolerance for a wide range of environmental variables.

Climax species such as woodland caribou, pine marten and grizzly bear, and a host of smaller birds and mammals, occupy habitats that are relatively stable, finite and often harsh. These animals are characterized by more prudent life history strategies, lower reproductive rates, traditional behavioural mechanisms to prevent habitat over-use, and less tolerance for environmental variables. These characteristics result in their being extremely vulnerable to disturbance. In response to increasing disturbance, populations of climax species will often decline gradually for a period of time and then drop catastrophically and sometimes irreversibly.

Current timber production objectives entail replacing old growth stands with young, rapidly growing stands to be harvested on short rotations. Such a change is beneficial to successional species but detrimental to climax species, who need old growth timber. Even successional species sometimes need mature timber for shelter and travel corridors during periods of high snowfall, such as blacktail deer and Roosevelt elk in the heavy snowfall areas of Vancouver Island. If wildlife management goals are to be met, timber programs must accommodate the habitat of all species.

During the past few years, some important cooperative initiatives have been undertaken between the wildlife program and the Ministry of Forests' protection program to utilize and expand the role of fire management. This embraces activities from the suppression of unwanted fires to the use of prescribed fire to attain wildlife objectives and its broad acceptance is important if these objectives are to be achieved.

Silvicultural operations, such as reforestation and brush control, influence the length of time that both mature and immature forests are productive as wildlife habitat. Various silvicultural practices such as thinning, prescribed burning and fertilization can enhance certain wildlife species.

Increased access is generally recognized as one of the major problems in wildlife management. General disturbance, collisions between vehicles and animals, and both legal and illegal hunting have resulted from enhanced access and have led to population declines in some species. In addition, access proliferation can significantly affect the quality of the recreational experience and greatly increase the costs of enforcing regulations.

Wildlife management can significantly affect timber operations. Deferring timber harvesting for purposes of protecting wildlife habitat can reduce the harvest rate in a given management unit in the long term (in the case of permanent reserves) and in the short term (in the case of temporary deferrals). It can also cause losses in volume during the period of deferral due to natural mortality and increased harvesting costs due to smaller cutting areas, the need for more roads and special equipment, and the need to shift operations into more isolated areas, onto steeper slopes and into lower quality stands.

As with other environmental resources, wildlife and timber interactions can be resolved through changes in resource allocation (e.g. by reserving old growth timber, reducing the rate of cut, changing the rotation age, accepting wildlife losses in certain areas), through modifying management practices (e.g. by changing silvicultural systems and forest harvesting techniques, managing high capability forest sites more intensively, implementing long-term access management, and enhancing habitat in areas designated for wildlife management to mitigate losses elsewhere), or both.

The Ministry of Environment contends that choosing among these options has been constrained by the lack of an effective integrative planning process for forest and range lands, by an overcommitment of timber in the allowable annual cut and by the lack of definitive information on the interactions between intensive forest management and wildlife and the costs and benefits of various management options.

TIMBER AND AGRICULTURE INTERACTIONS

Generally speaking, major conflicts between timber and agricultural programs are minimal. This is primarily due to special land use planning studies that resolved timber and agriculture land-allocation issues and to the completion of the Provincial Forest Program. Most Crown land suitable for intensive agricultural development has already been allocated for that use. Any land-allocation issues that do arise will likely be addressed through the Provincial Forest Review Program, and any management conflicts will be addressed on a site specific basis. One unresolved issue concerns who is responsible for stumping and debris removal costs when logging companies remove timber from lands destined for agricultural purposes.

Timber development and management can affect agriculture through forest encroachment and increased access which increases stock theft and disrupts stock movement patterns. Some forest management activities can also be beneficial to agriculture, particularly those in the area of intensive forest management. Agricultural developments can affect the timber resource when Crown forest land is converted to agricultural use and through physical damage to tree seedlings as a result of stock movement patterns.

TIMBER AND MUNICIPAL EXPANSION AND RURAL SETTLEMENT INTERACTIONS

As populations increase and as industries and municipalities expand, more and more land will be required for settlement and commercial development.

Settlement policy generally encourages growth within existing centres and, in rural areas, seeks to protect resource lands for continued resource production. In small holdings and rural residential or recreational lots, local government land-use regulations and Crown land allocation policies implement this settlement policy.

Municipal and rural settlement can affect forest management though reducing productive forest lands, increasing the cost of transporting wood products and imposing constraints on harvesting practices in areas immediately adjacent to settlement areas. However, conflicts between timber, municipal and rural settlement programs are expected to be minimal in the foreseeable future.

Where rural settlement occurs on or adjacent to forest lands, fire protection on those lands becomes much more complicated and usually more expensive.

The management and development of the timber resource can affect settlement in several ways:

- log transport and log sorting and handling facilities can cause noise and traffic problems in settlement areas, as well as competing for land and protected water with other settlement needs; and
- milling and residue disposal can produce air pollutants.

RANGE AND MUNICIPAL EXPANSION AND RURAL SETTLEMENT INTERACTIONS

The amount of spring and fall range is an important factor in beef cattle production. Most spring and fall ranges are open range lands or open forest lands located in valley bottoms and on the lower slopes of valleys, the same areas where urban and rural development can be expected to occur. Settlement usually wins out over forage production thereby creating problems for range management, not only because of reduced forage production, but also because of reduced recreational use of rangelands, stock harassment and increased cattle rustling.

Once lands are designated for settlement, it is assumed they will not contribute, at least in the long term, to Crown forage production. Any program integration required between range and settlement is usually handled reasonably effectively through consultation on site-specific issues.

It is worth noting that private rangeland comes under the administrative mandate of local government. Because both private and Crown range contribute to the supply of grazing opportunities, often in a complimentary fashion, range policies require cooperative development by local and provincial agencies.

TIMBER AND FOSSIL FUELS INTERACTIONS

Many of the oil, gas and coal reserves are located under productive forest lands. During exploration and development of these resources, trees are removed to construct roads, seismic lines, trenches, pipelines and development sites. This can lead to reductions in the productive forest land base and the long-run sustainable yield. It can also lead to increased hazard from wildfire and perhaps forest insects.

The timber resource management does not usually conflict with exploration and development of fossil fuels. In fact, timber developments can facilitate mineral and petroleum exploration.

Very little coordinated planning of timber and fossil fuels, more particularly oil or gas, occurs at the management unit or local planning levels. The developer is required to obtain licences to cut before trees can be removed for exploration or development purposes. In some cases, the Ministry of Forests is unaware of the details of a proposal until an application is received. Often this is too late to successfully integrate the timber program with the development.

TIMBER AND AIR INTERACTIONS

The goal of the Air Management Program of the Ministry of Environment is to maintain atmospheric quality in British Columbia at a level conducive to good public health, scenery and visibility.

Slash burning, wood-waste burning at timber processing sites and the prescribed burning of forest land for range improvement purposes result in increased levels of suspended particulates and in reduced visibility. The extent to which these practices are used in British Columbia and the contribution of such burning programs to reductions in ambient air quality should be better understood. The Ministries of Forests and Environment could then develop burning strategies as part of local resource planning processes to ensure that provincial air quality objectives are met outside the burning area. The costs and benefits to timber management of implementing such strategies would also have to be determined.

TIMBER AND MARINE RESOURCES INTERACTIONS

The goal of the Marine Resources Program of the Ministry of Environment is to manage the commercial fish processing and buying sectors, mariculture, wild oyster resources and marine plants to maximize their economical and social benefits.

The major conflicts between forest management activities and the Marine Resource Program relate to water quality deterioration and habitat destruction arising from log storage and handling activities on the foreshore. Such conflicts must be addressed through integrated planning mechanisms.

The Ministry of Lands, Parks and Housing adjudicates foreshore use. Allocation of foreshore user rights takes place through the processes of Crown foreshore plans and referrals of foreshore lease applications to other agencies.

TIMBER AND PESTICIDES INTERACTIONS

The goal of the Pesticides Management Program of the Ministry of Environment is to ensure that pesticides are sold and used safely to protect human health and to maintain environmental quality.

The Pesticide Control Branch of the Ministry of Environment adjudicates and licenses such use on public land. The Pesticide Control Committee and Environment Canada's Environmental Protection Service review applications for permits.

A use permit normally requires that the permit holder be a licenced pesticide service or employ a licenced pesticide service licensee if the application is to be made on public land. Service licences are issued by the Pesticide Control Branch and every application crew must be accompanied by a certified pesticide applicator on both public and private forest land. A certified pesticide applicator is a person who has successfully completed a Pesticide Control Branch course and examination in a specialty field.

In most cases, the permit holder must give public notice of his intended pesticide application to local residents several weeks before beginning the spray program. Any permit is subject to appeal by any citizen in the province. If the applications of the appeal system are met, the Environmental Appeal Board conducts a public hearing, usually in the area of the intended pesticide application.

Members of the British Columbia Pesticide Control Committee often inspect sites before and after treatment to determine the need, to check for misuse and to ensure that all the conditions of the permit are met. Special use permits (generally permits for research on unregistered pesticides) are handled in a similar manner.

In certain situations the use of pesticides to control forest insects and herbicides to control competing vegetation in forest plantations is the only practical option for the Ministry of Forests. There has been considerable resistance from the public and from environmental groups to the use of pesticides and herbicides. Prohibition or significant limitation on the use of these tools could have serious implications for forest management in British Columbia.

FOREST RECREATION AND OTHER PROVINCIAL AGENCIES INTERACTIONS

Forest recreational uses often are associated with resource values that are managed by other agencies. Such resource values include fish, wildlife, heritage sites, foreshore areas, etc. Regulations developed and administered by these agencies have direct impacts on forest recreational activities and their management: for example, the All Terrain Vehicle Act regulations, Small Boat Regulations (Canada Shipping Act), Hunting and Fishing regulations.

Administration by other agencies of "nonforest uses" in Provincial Forests, as defined in protocol agreements, may often have a major bearing on the Ministry's forest recreation management. These include leases or licences for commercial recreation operations and related tenures, and recreation cabin permits. The uses which these tenures generate on Crown land can impact directly on Ministry recreation plans.

Some protocol agreements pertaining to recreation exist with the Ministry of Lands, Parks and Housing. However, some of the interactions still hold potential for conflicting decisions. Recreation corridors, such as trails and rivers, crossing various jurisdictions are prominent features for which formal mechanisms for coordination are pending. Mineral exploration in scenic or recreationally sensitive areas is another field where there should be a formalized approach to seek common grounds.

CHAPTER F4

MAJOR ISSUES IN INTEGRATED RESOURCE USE

The major issues in integrated use relate to the clarity of resource use objectives, provisions for environmental protection, land reallocation provisions, choice of silvicultural systems, rate of timber harvest and administration of Provincial Forests.

INTEGRATED RESOURCE USE OBJECTIVES

At present, conflicts arising from decisions regarding how land will be used are addressed by negotiation among various resource management agencies. If resolution is not possible government becomes the final arbitrator. This method arose principally because it is the only one that can cope with the uncertainties of environmental regulation and ill-defined integrated use objectives in a practical way. While administratively cumbersome, it has allowed reasonably effective plans to be prepared for most areas, but increasing demands for resources threaten to burden the managers with escalating unresolved controversies.

Operational processes embodied in Coordinated Resource Management Plans and Folio Plans have been asked to do much in the past. Such pragmatic, operational planning processes, no matter how well conceived, cannot be fully effective in a policy vacuum. They must be placed within the context of integrated resource management objectives at the provincial and strategic level. If not then they may produce ad hoc, short-term agreements allocating the resource among the most vociferous users or degenerate into interagency arguments.

The land base and the resources on it cannot be managed rationally until integrated resource management objectives are clarified. Only then can decisions be made regarding appropriate resource uses. An effective resource planning process must therefore consist of the following steps:

1. Formulation by each agency of preliminary resource management objectives. These objectives should be based on perceptions of public expectations and knowledge of land capability, competing uses and management funds available to carry out associated programs.
2. Integration of objectives and resolution of conflicts to achieve the most desirable total mix of resource production with due recognition of costs and benefits.

3. Statements of integrated resource management objectives for administrative regions. These statements arise out of the second step and should not carry forward incompatibilities that would thwart further planning efforts at the operational level. They would be approved by government as resource use policy for the region.

4. Continuation of operational processes much as is done today except that, with clear goals, resource staff in the various agencies will be better able to pool their collective abilities to deliver the predetermined products.

Contentious decisions and unresolved issues resulting from negotiations over land and resource use among the technical agencies and their respective client groups are currently arbitrated by government. In these cases, the planning processes, which are designed to assist negotiations and provide mediation, generate compromises which are usually based on objectives as seen from the local point of view. When these plans are subsequently directed to higher levels of decision-making where they are viewed in terms of broader social and economic objectives, none may be acceptable. This has tended to undermine the image of government and resource agencies alike and to discredit further attempts to generate optimal resource plans. The solution is to develop more clearly enunciated resource allocation policies.

ENVIRONMENTAL PROTECTION

Protecting the environment is an important responsibility of integrated use management. To ensure environmental concerns are addressed in resource developments, various assessment procedures have been stipulated in a number of statutes. In addition to the Environment Management Act passed in 1981, some 45 statutes refer to some aspect of environmental and social impact but no one Act specifically deals with the forest environment. Rather, environmental protection is an integral part of forest management planning. Environmental assessment legislation is project-oriented, but forest management activities do not occur as discrete projects as do pipelines, new mines or reservoirs for hydroelectric power. Experience has shown that project-oriented impact studies may not adequately protect the environment. It is better to make project decisions in the context of comprehensive land-use planning, and procedures associated with environmental impact assessment such as project screening, public participation and community impact assessment must be integrated with overall resource management planning. In this way flexibility is retained to achieve the optimal balance between development and protection objectives.

It has been pointed out that environmental regulation in British Columbia is essentially a bargaining process. For example, in the case of fishery/forestry regulation, the Westwater Research Centre at the University of British Columbia identified the key feature of this process to be bargaining primarily between the forest industry, the Ministry of Forests, the Fisheries Branch and the federal Department of Fisheries and Oceans, which takes place at the provincial, watershed and site-specific levels.

The Forest Act requires the Ministry of Forests to take account of total resource and environmental values when regulating timber cutting, which is a mandate consistent with a negotiating and bargaining approach to regulation. The federal Fisheries Act arbitrarily requires that fish and fish habitat be protected and prohibits any practices, including logging, that are likely to harm fish or fish habitat. In practice, though, standards and objectives are negotiated in individual cases where conflict potential exists.

LAND REALLOCATION PROVISIONS

The government approves the issuance of extensive long term tenures to the forest industry for using and managing the forest resource. It also has the prerogative to reallocate lands to other higher uses and socially desirable purposes. The withdrawal provision under Section 53 of the Forest Act is one of the means available for reallocating land use. However, when compensation becomes due under this Section, it can become the source of considerable controversy. The cost of compensation can be so high as to become a determining factor in government's decision to reallocate.

Some current forest tenures have limited terms. By granting timber rights for a limited time with no right to renewal, the Crown can review the prudence of the grant at the expiry of the term and revise it as appropriate.

CHOICE OF SILVICULTURAL SYSTEM

The silvicultural system used has a major impact on the ability of forest lands to support integrated uses. In British Columbia, the most frequently used silvicultural system is clearcutting. This is primarily due to the biological requirements of the tree species, as well as harvesting technology and economics. Clearcutting is also indicated when disease, insects or unmerchantable volumes prevail and is frequently needed to sanitize an area and to reduce fire hazard.

However, on biologically sensitive sites or on sites having high recreational or aesthetic values, clearcutting may be deemed inappropriate or unacceptable. Group selection, strip selection and shelterwood systems are systems that may be used as preferred alternatives to clearcutting in some areas.

"Faller's selection", a selection system in which trained fallers select the trees to be cut, shows widespread potential in the dry-belt fir type. Early indications suggest that normal yields for this forest type can be increased significantly by applying this practice through periodic harvests about 20 years apart.

Commercial thinning may show good returns and may increase yields when applied on good sites close to manufacturing plants. Commercial thinning, selection or shelterwood systems may be particularly applicable to woodlot licences and other similar tenures where more intensive management is possible.

Currently, the trend is to make site-specific preharvesting prescriptions within ecological guidelines and to deviate from the clearcut, burn and plant philosophy where it is appropriate. This approach has evolved as multiple resource values have become more widely recognized. However, clearcutting to promote even-aged forests of fast growing, intolerant pioneer species will likely continue as the dominant silvicultural system under most conditions. The use of prescribed fire will also remain a major treatment to consume slash, to control insects, disease and brush and to prepare seedbeds or planting spots. There is, as well, the need to utilize pesticides, especially on coastal sites as part of the overall silvicultural system.

RATE AND DISTRIBUTION OF TIMBER HARVEST

The timber management decision with perhaps the greatest impact on integrated use objectives is the choice of the rate and spatial distribution at which logging will proceed within localized areas such as individual watersheds. It is a significant management consideration when there are concerns about wildlife habitat, aesthetics, long-term timber supply management, forest protection, silviculture, water supplies or fish habitat.

For example, the primary goal in wildlife management is to produce habitat diversity - a mosaic of different aged forest stands throughout a watershed. This goal is achieved through applying restrictions to the rate of harvest to manage habitat primarily for big game species: caribou, grizzly bear, moose, elk, mule deer and blacktail deer. The rate of harvest recommendations vary from watershed to watershed, reflecting not only the habitat needs of different wildlife species but also the different local habitat requirements of a wildlife species within its range. Some needs include food and cover for seasonal habitat, limiting clearcut size where distance to cover is critical, and providing a good spatial distribution of different aged forest stands (i.e. clearcut to mature forest in a mosaic throughout a watershed). In many cases, winter habitat is a limiting factor for wildlife. Because winter habitat is frequently mature forests, there may be a need for a significant portion of the watershed to remain undisturbed until cutovers have regenerated to near-maturity. The age of forest stands to provide suitable winter habitat can vary from young mature for blacktail deer to over-mature where caribou require arboreal lichens. In order for the mature forest areas to be harvested, there must be another area with suitable winter habitat characteristics (i.e. a mosaic of forest age classes would permit continued forest harvesting and provide suitable winter habitat).

Aesthetics are an important forest management concern along major transportation routes and around communities. Reducing the aesthetic impact of forest harvesting, and clearcutting in particular, requires landscape architectural techniques such as tailoring cut blocks to the terrain and in some cases leaving stands to reduce the visual impact of clearcuts. The latter leads to a limit on the rate of harvest until such time as the regeneration in the cut block has visually recovered (e.g. the trees are visible above the snowpack).

The removal of forests by logging can change the characteristics of water quality and quantity and the timing of stream runoff. This is turn affects water-related resources such as fisheries and domestic/industrial water supplies which are significant products from forested watersheds. Experience and research has shown that even if excellent erosion control measures are taken, completely clearcutting the forests over a short period of time can lead to significant changes in runoff, causing deterioration of stream channel and water quality. The extent of harvesting that can be done in a watershed before water supplies and fish habitat are adversely affected varies from watershed to watershed.

Roads required for forest harvesting generally occupy a very small percentage of a watershed (usually less than 8%), yet their presence can be hydrologically quite significant. Roads intercept slope water and accelerate its drainage through ditchlines to creeks. Peak flow increases of 35 to 102% have been attributed primarily to roads.

Since roads have a long term presence in a watershed, great care must be taken in planning, construction and maintenance. The primary focus should be to avoid unnecessary road construction and provide adequate cross road drainage for intercepted water. These measures can reduce, but will not eliminate, the impact of roads on the water resources.

Forest harvesting activities lead to exposure, disturbance, excavation and loading of soil, interception and re-routing of slope water and removal of the forest canopy. These changes increase or accelerate the natural level of surface erosion and landslides. Conscientious work can do much to reduce erosion, for example recognition of erosion, detailed planning, changes to the scheduling of activities, close supervision, experience in an area and the use of appropriate equipment. However, not all erosion problems can be forecast. In watersheds where water quality and stream channels are a concern for water users, applying an appropriate rate of harvest help to limit the extent of unexpected erosion.

Adherence to sound forest practices such as those outlined in the proposed Coastal Forestry - Fisheries Guidelines will do much to reduce the impacts of forest harvesting on water resources but even the best practices will fail to protect the water resources from impacts caused by an excessive rate or amount of timber harvesting within a watershed. There is a threshold when a watershed responds in a negative hydrologic manner to more disturbance. This threshold may be the result of one factor such as increased peak streamflows or it may be the cumulative effect of many factors. Sound integrated use forest management requires that the limits be identified during watershed planning and an appropriate rate of cut determined before any logging commences.

ADMINISTRATION OF PROVINCIAL FORESTS

The establishment of Provincial Forests by the Ministry of Forests has been a contentious issue for many years. A discussion paper was circulated to concerned ministries in January 1979 detailing program objectives and time frame for completion. It proposed that all Crown land not already in a

Provincial Forest should be assessed and classified into two broad categories, with large continuous tracts best suited for long term integrated resource management designated as Provincial Forest and all remaining forest land best suited for agriculture, settlement or other single use designation excluded from reserve status. A planning process would be established quite independently of other forest management planning systems which would involve the participation of other land and resource ministries over a number of years.

Although the discussion paper was careful to point out that the program was not intended to "establish forevermore the optimum use for every acre of land in the province," but should be viewed instead as an "initial broad zoning to establish in general terms the land base available for integrated forest management", opposition from other ministries quickly developed. Central among these was the Ministry of Lands, Parks & Housing, which saw conflicts with its recently established program for making Crown land available for agricultural or housing purposes in rural areas of the province. Many of the areas proposed for Provincial Forest status in the Cariboo and Peace contained the best land available for sale under their program. More generally, fears were raised that the program was but a thinly disguised land grab at the expense of other ministries in order to secure large areas of the Province for single use timber production. These perceptions displayed a lack of understandings as to what Provincial Forest status is intended to accomplish.

As the multiple use nature of Provincial Forests was subsequently clarified, much of this resistance to the program subsided and the process of mapping remaining reserves continued according to plan. Initial difficulties over the apparent conflict in objectives between the establishment of Provincial Forests and the disposition of Crown land for residential and agricultural use were resolved in January 1981 by a directive from the Premier to create Deferred Planning Areas where conflicting uses indicated the need for further study. Of the 47 different areas proposed for study, 37 were actually initiated and all but 6 have now been completed.

By 1984, the program of establishing Provincial Forests was nearing completion with 134 designated and 5 proposals awaiting final approval. Provincial Forests presently cover over 70 million hectares or approximately 74% of the province's land base with further additions expected in the near future.

An important outcome of the program will be a greater predictability and stability of timber supply to an industry long plagued by erratic land allocation decisions. The security afforded by Provincial Forest status will not only protect existing investments but should also create an incentive to make further investments in intensive silviculture, reforestation and improved manufacturing facilities.

There has been extensive interagency negotiations including the question of ministerial responsibilities and jurisdiction over administering Provincial Forest lands. A set of agreements and protocols were developed to clarify the respective roles of ministries and to specify procedures for dealing with interagency interests. The agreements with the Ministry of Lands, Parks and Housing illustrate the division of administrative responsibilities. These confirm the Ministry of Forests retains responsibility for administering the forest uses and range resources while the Ministry of Lands, Parks and Housing assumes responsibility for planning and administering all nonforest uses. A 1983 subsidiary agreement establishes the procedures for deleting Crown land from Provincial Forests.

These agreements do not cover Provincial Forest lands within Tree Farm Licences. With recent interest being shown in expanded use of this tenure in forest land management, other agencies have expressed some concerns over the administration of nonforest uses. These concerns may be addressed in a new subsidiary agreement being developed to set out management guidelines and expectations for these areas.

Designation of Provincial Forests avoids unjustified disposition of the resource base to alternate uses, while making provision to accommodate necessary land withdrawals for higher valued uses. Under the periodic Provincial Forest Review Process, land withdrawals will be permitted only after careful consideration of the resulting impact on forest, range and dispersed recreational values compared to the social and economic benefits of the alternate use.

In spite of provisions for outside agency participation plus concessions on administration procedures, the Ministry of Forests has not completely dispelled the stigma attached to the lead agency approach to Provincial Forests. Ministries that initially opposed the program continue to hold reservations about the equitability of decisions. The Ministry of Lands, Parks and Housing, although cooperating on operational matters, continues to be philosophically opposed and makes the argument that the best land allocation decisions require a neutral perspective not attainable under the current structure. The Ministry of Agriculture and Food also remains critical of the lead agency approach to land use planning for it casts other ministries in a reactive role. Land use decisions are arrived at through an adversarial process rather than as a result of conformity to some overall government policy. It should be noted, though, that each agency has a mandate that belies a neutral position and these vested interests will continue to thwart land-use planning until such time as clear government policy is developed to enable nonpartisan planning. Alternatively, continued pursuit of mutually acceptable protocols and demonstrated resolve to recognize other interests in forest land may eventually establish credibility in the Ministry of Forests' intentions.

It will be through the Provincial Forest Review Process that ministry intentions are tested and fine tuning achieved to the satisfaction of all agencies involved. In many respects, this process when it is in place will represent a continuation of policies and procedures introduced during the establishment phase of the program. Proposed boundary changes will be required to show that a greater social and economic benefit will result from the addition or deletion in question. In arbitrating these uses, the Chief Forester will be under intense scrutiny by other agencies and interest groups as impacts on forest and range resources are weighed against alternate values.

SECTION G

BRITISH COLUMBIA'S RANCHING AND FOREST INDUSTRIES

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CHAPTER G1

BRITISH COLUMBIA'S RANCHING INDUSTRY

Cattle ranching in British Columbia had its origins in the wake of the gold rush that swept through the interior between 1858 and 1865, filling the country with hungry prospectors. To meet the increased food demand, cattle were brought in from the United States in massive cattle drives.

The British Columbia colonial administration was quick to recognize the potential for stock raising in the British Columbia interior and instituted a generous landlease policy for agriculture. Leases of 100,000 acres (40,000 hectares) could be had for one cent an acre. Ranches soon sprung up along Cariboo Road and other cattle drive routes. Once the gold fever had run its course and local food demands plummeted, a number of operations were abandoned. The ranchers who remained pieced together many of the larger operations still in place today.

The arrival of the railroad in the British Columbia interior in 1885 marked the birth of the modern ranching era (making 1985 the unofficial centennial year for the British Columbia ranching industry). Towns served by the railway grew quickly and created a considerable local beef market. The railway also provided cattlemen with direct access to beef markets in the United States. As a result, British Columbia's cattle herd grew from 70,000 head to 100,000 in the ten years from 1887-1897.

By the early 1920s most land suited to cattle ranching had been claimed and large ranching companies had come to dominate the ranching scene.

ADMINISTRATION

Administration of Crown grazing lands was relatively haphazard until 1919 when the Grazing Act was passed and the position of Commissioner of Grazing was established within the Forest Branch of the Department of Lands. However, the department had virtually no administrative staff to ensure that the ranchers adhered to the terms of the permits issued to them under the Act. During the post-war period, the Department of Lands, Forests and Water Resources appointed more staff and brought some administrative control to rangeland use. In the 1970s, the Department of Agriculture began an extension service to provide professional advice to ranchers about range management and appointed a range specialist for the province.

In 1978, the Range Act replaced the 59-year-old Grazing Act. This new legislation reconfirmed the Ministry of Forests' commitment to managing British Columbia's rangelands according to multiple use principles and encouraged land use stewardship by providing longer-term grazing licences than available under the Grazing Act.

In 1980, the Ministry of Forests and the Ministry of Agriculture and Food signed a formal memorandum of understanding detailing the division of range management responsibilities. The Ministry of Forests is to play the major role in planning and administering rangeland use; the Ministry of Agriculture and Food is to carry out extension and demonstration work along with research and education programs. The two ministries agree to cooperate fully in developing Crown range and private grazing systems.

CATTLE REARING

Originally, cattle were put out to graze year round but the few available winter ranges soon became overgrazed and unproductive. Ranchers today commonly provide forage for their cattle over the winter months and graze them on grasslands or forested range in the spring, summer and fall.

The relatively high costs of feeding cattle throughout the winter has had a marked impact on the character of the British Columbia ranching industry. The typical British Columbia rancher runs a cow-calf operation in which calves are born in the spring and spend the summer with the herd on the range. In the fall, most of the calves are sold but a few heifer calves are kept to replace the cows culled from the herd.

Most of the calves produced each year enter the next stage of beef production known as "backgrounding". The calves, which usually weigh an average of 200 to 225 kilograms, are fed hay and grain to increase their weight by about 135 kilograms. Then they enter the finishing stage. The calves are fed high-energy rations of pure grains to achieve the maximum weight gain in the shortest period of time. "Fed" cattle are slaughtered once they weigh in the neighbourhood of 450 kilograms.

Backgrounding is usually done in one of two ways. In the first, a rancher keeps some of his surplus calves through the winter and feeds them home-grown and purchased forage (hay, silage, grain). The following summer, he grazes them on range or pasture land. In the fall, he sells them as steer or heifer yearlings ready for finishing. This is a relatively inexpensive but slow-paced backgrounding method.

The second involves enterprises called feedlots that specialize in the business of buying calves expressly for backgrounding or for backgrounding and finishing. Calves are fed a high-quality forage diet along with feed grains and protein and mineral supplements. This enriched feeding program doubles the animals' growth rate over the first method and thus prepares them for finishing much more quickly.

Variations to the two basic approaches to backgrounding are numerous. In fact, backgrounding is the most highly diversified sector of the ranching industry.

Approximately 60 feedlots operate in British Columbia. About half of these offer finishing services; the other half offer either backgrounding, or both backgrounding and finishing.

Because of the volumes of grain required to produce finished cattle, bringing the calves to the grain is more economical than bringing the grain to the calves. British Columbia produces limited amounts of feed grains compared to the prairie provinces and Ontario produces large quantities of corn silage expressly for finishing cattle. For this reason, many British Columbia calves are shipped out of the province to feedlots in Alberta and Ontario.

THE RANGELANDS

Two types of rangelands are found in British Columbia: forested range and open grassland. Forested range covers 11 million hectares, most of which is Crown land administered by the Ministry of Forests. Grasslands cover an additional 1.2 million hectares, most of which is under private ownership and constitutes much of the province's valuable spring, fall and winter grazing land.

Forested range is managed for its trees as well as its forage and all rangelands are managed for both wildlife and cattle. British Columbia's rangelands are the prime habitat and feed source of elk, moose, bighorn sheep and deer. Each species has forage requirements that vary throughout the year and that overlap with other big game species and cattle. Accommodating interactions of this kind, often in conjunction with logging, poses challenging administrative problems.

As the ranchers of 100 years ago learned, rangelands, especially the drier grasslands, are sensitive ecosystems, highly susceptible to overgrazing which can result in rangelands being completely overrun with plant species unsuitable for livestock. Thus, the range administrators are mainly concerned with controlling the number of cattle grazing a particular area. This grazing limit is expressed in terms of Animal Unit Months (AUMs). If the stocking rate is set at four hectares per AUM, one animal put out to graze for one month would be allocated four hectares of rangeland to satisfy its forage needs; if that same animal stayed on the range for six months, it would be allocated 24 hectares.

For Crown range, the permissible use is set by the Range Management Branch of the Ministry of Forests and is based on that ministry's estimate of the rangeland capacity to accommodate cattle in a multiple-use setting. Stocking levels greater than the approved number of AUMs could damage the range ecosystem, disturb wildlife habitat and reduce rangeland forage production.

In 1981, of the estimated 11 million hectares of Crown rangeland available for grazing, the Ministry of Forests allocated a total of 8.3 million hectares to the ranching industry, providing an all-time high of 996,000 authorized AUMs. This represented about 60% of the industry's rangeland use for the year. An estimated 1 million hectares of private land accounted for the other 40%, or approximately 600,000 AUMs.

In most areas of the province the lack of spring and fall grazing opportunities limits expansion of the beef industry. Therefore, before British Columbia beef production can increase significantly, either the productivity of spring and fall rangelands will have to be improved through intensive management practices or new spring and fall pastures will have to be created.

THE BEEF INDUSTRY

The beef industry is a major economic and social force in British Columbia.

In 1981, the total capital value of all farm holdings in British Columbia including lands, buildings and livestock was estimated at roughly $8.5 billion, close to 75% more than the 1971 figure of $4.9 billion (1981$). In terms of farm cash receipts, the beef industry accounts for 11 to 14% of the agricultural industry in British Columbia, putting it in third place behind the dairy industry and the poultry and egg industry. In 1983 the cash receipts from cattle operations were nearly $113.8 million, compared to $839.5 million for agriculture as a whole. (Here again, the figures use 1981 dollars.)

Between 1971 and 1981, the beef production grew 25% while in the rest of Canada, production declined by 3%. British Columbia's better-than-average performance can be attributed to three factors. First, the rangelands do not lend themselves to alternative uses. Therefore, a rancher, unlike most of his counterparts in other provinces, cannot shift out of cattle production into some other type of agriculture. Second, the typical British Columbia rancher carries on regardless of the prevailing economic conditions. Third, the Farm Income Insurance Program helps ranchers weather hard economic times. However, in spite of its impressive growth, the cattle industry produces only about 7% of Canada's beef cattle even though British Columbia has 11% of Canada's population.

In the record production year of 1981, the beef cow herd numbered 234,000 animals and the total number of beef cattle in the province, including calves, heifers (one-year-old females) and steers (one-year-old males), came to more than 700,000 head.

In response to the increased cattle production, forage production also increased. The total area in hay production in 1981 was 290,000 hectares, an increase of 82,000 hectares over the 1971 figure of 208,000 hectares. Over the same ten-year period the area of corn silage production increased from 5,000 hectares to 12,000 hectares, improved pasture from 161,000 hectares to 267,000 hectares, and irrigated land from 89,000 hectares to 100,000 hectares. During the same period, the total amount of private farmland fell by 185,000 hectares, from 2.2 million to 2 million.

Over 25% of British Columbia's cattle are produced in the northeast; the ranching industry centered around Kamloops produces 24%; the Cariboo, 21%, and the Okanagan, 15%. The breeding herd is concentrated in the Kamloops and Cariboo regions.

In 1981, 11,246 ranches reported cattle production. Only 2,907 of these were larger than 100 hectares but they produced 68.8% of the cattle.

The beef finishing sector of the industry is concentrated in the Fraser Valley region close to the province's major slaughter cattle market. The 28 feedlots found here can together feed about 25,000 to 30,000 head per year.

Feed costs along with bank interest rates are the key production costs for all sectors of the beef industry. In 1980, feed alone accounted for 35 to 50% of costs in cow-calf operations, 40 to 50% in backgrounding programs and about 55 to 60% in feedlot production.

Because of the rapidly increasing cost of feed grains during the past decade, several custom and on-farm backgrounding facilities that use more forage and less grain have been established. However, although feed costs have increased substantially, they continue to increase at a lower rate than nonfeed costs. Since many of these other costs (interest, labour, overhead) accumulate on a daily basis, a high-energy, grain-based feeding program usually averages out to be more cost effective than a longer term program that makes more use of forage.

Beef prices peak every six to nine years, and prices for calves and yearling steers peak every five to seven years. Ranchers try to adjust their herd sizes to stay in tune with the two markets but this is difficult since it takes a good two years to effectively increase herd sizes. By then, ranchers can find themselves two years behind the latest market trends.

The most recent peak in beef prices occurred in 1979 and ranchers rushed to increase the size of their herds. By 1981, when the size of the British Columbia cattle herd had reached its all-time high of 234,000 animals, beef prices were already dropping and interest rates were rising. Ranchers were forced to reduce the size of their herds, and by 1983 the herd was down to 222,000 animals. Projections for the next five years indicate that beef prices will rise slowly and the industry will experience a modest recovery.

BEEF SUPPLY AND DEMAND

In 1974, British Columbia slaughtered enough cattle to meet 17.1% of its beef requirements; by 1982 the figure had reached 26.6%, an increase of 9.5%. Nonetheless, this is still well below self-sufficiency.

In 1982, the number of cattle slaughtered in British Columbia was approximately 127,000 and the slaughterhouses reported handling 30 million kilograms of beef. For the province to be self-sufficient, it would have to supply approximately 113.5 million kilograms of beef annually by slaughtering about 480,000 finished cattle.

Since British Columbia's beef production fills only a quarter of the province's needs, supplies from other provinces, primarily Alberta, make up the difference. One should realize that a portion of this 'imported' beef comes from British Columbia calves shipped to Alberta for backgrounding and finishing. While exact figures are unavailable, some estimates indicate that

100,000 cows and calves produced in British Columbia are shipped to Alberta, Ontario and the United States.

RANCHING INDUSTRY POTENTIAL

Over the next five years, the ranching industry will experience modest increases in beef production as a result of expansion of the cow-calf breeding herd, increases in backgrounding operations, and improvements in livestock and range management practices. However, any major increases in production to bring British Columbia closer to self-sufficiency would require significant developments in the following four key components of the industry. As illustrated in these comments, some serious constraints need to be overcome. More intensive livestock and range management practices seem to offer the most likely long-term potential but the economic feasibility of expanding the beef industry must be assessed before any option is seriously pursued.

1. Increased cow-calf production.

This would require a major expansion of the province's basic cow herd.

Because most ranches in British Columbia are engaged in cow-calf production, this is a realistic possibility. A current constraint is insufficient spring and fall grazing land but Crown lands could play a significant role in overcoming it if clearcuts were managed more intensively. The most important constraints include the high costs of purchasing or producing additional winter forage, the need for additional facilities and manpower, and perhaps the lack of available water for increased hay production.

2. Increased levels of backgrounding.

This could be done by either increasing yearling production or expanding feedlot facilities, or both.

The former would require that ranchers retain more calves on the home ranch over the winter, feeding them until they are ready for finishing. Since British Columbia farmlands are capable of producing more forage than they do now, this could be done. However, forage production is expensive and larger herds require more manpower. Whether or not it would be cost effective requires further study.

The latter, increasing feedlot facilities, would require that existing facilities be expanded and new ones built. The constraints are a lack of trained personnel and the high railway freight rates which make importing feed grains expensive.

3. Intensified livestock management practices.

By improving the breeding stock and by providing them with better quality forage, heavier calves and yearling could be produced.

Intensified livestock management should be viewed as a long-range strategy since it involves major modifications to current management practices. These include applying the latest breakthroughs in genetic research to improve the quality of livestock, providing more and better pastures, and using more sophisticated grazing regimes including rotating cattle through a sequence of pastures and rangelands.

4. Intensified range management practices.

Available research indicates that applying a number of range management techniques could increase livestock production on the current rangeland base without prejudicing other range uses. Additional research would probably reveal even more range management opportunities to optimize livestock production. Utilization trials might be conducted to test various range use options.

The management of spring and fall pastures demands more attention. Improvements in this area are essential if provincial livestock numbers are to increase substantially.

In certain areas of the province, cattle are excluded from grazing on Crown range to protect alternate range uses. These rangelands might accommodate grazing cattle as well if a more comprehensive management program were in place that integrated the various uses.

Intensive range management is an ambitious goal and must mature over time. The overall intention should be to develop a more thorough understanding of all rangeland interactions so that managers can make more effective use of the resource.

CHAPTER G2

BRITISH COLUMBIA'S FOREST PRODUCTS INDUSTRY

British Columbia's economy has been heavily influenced by the expansion of its most important sector, the forest products industry. Growth to its present size and importance has been based on its ability to supply foreign markets reliably with competitively priced, quality forest products. No single statistic can adequately capture the importance of the forest products industry to the provincial economy but its significance can be judged from its contributions to manufacturing output, employment, exports and government revenue. This chapter discusses the significance of the industry to the provincial economy, describes its major sectors and provides details about its markets.

DEFINITION OF THE FOREST PRODUCTS INDUSTRY

Although commonly referred to as a single entity, the forest products industry actually comprises a wide variety of activities ranging from logging to various wood-based manufacturing activities such as sawmilling and papermaking.

In this report, the forest products industry includes logging, wood industries, and paper and allied industries, as specified in the Standard Industrial Classification (S.I.C.) of Statistics Canada. The components of the forest products industry are shown in Table G-1.

While Table G-1 shows 11 components, the industry is dominated by a subgroup of four:

(i) logging,
(ii) sawmills, planing mills and shingle mills,
(iii) veneer and plywood mills,
(iv) pulp and paper mills.

This chapter concentrates on these dominant components.

As evident from Table G-2, this subgroup accounts for approximately 93% of total value added in the forest products industry. While not identified separately in this table, the sawmills and planing mills component accounts for approximately 96% of total value added in the sawmills, planing mills and shingle mills industry. The remaining 4% is attributable to the shingle mills component.

Table G-1. The Forest Products Industry

S.I.C. Number	Industrial Sector
	Logging
031	Logging
	Wood Industries
251	Sawmills, planing mills and shingle mills
252	Veneer and plywood mills
254	Sash, door and other millwork plants
256	Wooden box factories
258	Coffin and casket industry
259	Miscellaneous wood industries
	Paper and Allied Industries
271	Pulp and paper mills
272	Asphalt roofing manufacturers
273	Paper box and bag converters
274	Miscellaneous paper converters

Source: Standard Industrial Classification Manual, Revised 1970 (Statistics Canada no. 12-501E).

Table G-2. Value Added in the Forest Products Industry 1979 - 1981 Average

Industry	Millions of Dollars	
Logging		1,055
Wood Industries		
Sawmills, Planing Mills and Shingle Mills	1,367	
Veneer and Plywood Mills	226	
Other Wood Industries	178	
Subtotal		1,771
Paper and Allied Industries		
Pulp and Paper Mills	1,268	
Other Paper and Allied Industries	100	
Subtotal		1,368
Total		4,194

Source: Canadian Forestry Statistics (Statistics Canada no. 25-202)

MANUFACTURING OUTPUT

The forest products group, consisting of wood industries and paper and allied industries, normally accounts for approximately 50% of the total value of shipments by manufacturing industries. The next most important group, the food and beverage industry, usually accounts for only 15% of total shipments.

Table G-3 shows the value and share of total manufacturing shipments attributable to the forest products industry in the period 1979 through 1983. In 1983, shipments by the forest products group totalled $7.6 billion which represented 45% of total manufacturing shipments. The decline in the value and share of shipments by the forest products group through 1982 reflects the cyclical nature of forest product markets.

Table G-3. Value of Shipments by Manufacturing Industries

	1979	1980	1981	1982	1983
		(millions of dollars)			
Forest products					
Wood industries	4,841	4,522	4,138	3,531	4,787
Paper and allied industries	2,537	3,084	2,898	2,742	2,793
Subtotal	7,378	7,606	7,036	6,273	7,580
Other manufacturing industries	7,253	8,290	9,774	9,104	9,232
Total	14,631	15,896	16,810	15,377	16,812
Forest products share (percentage)	50	48	42	41	45

Source: Inventories, Shipments and Orders in Manufacturing Industries (Statistics Canada no. 31-001).

EMPLOYMENT

The forest products industry generally provides direct employment for about 95,000 persons, which represents approximately 8% of total provincial employment. The actual level of employment in the industry, however, varies significantly over the economic cycle. As shown in Table G-4, direct forest industry employment declined to approximately 76,000 persons at the depth of the recession in 1982.

The indirect employment created in those sectors of the economy that supply goods and services to the forest products industry and its employees considerably exceeds the number of workers employed directly in the industry itself. In total, the forest products industry is estimated to provide employment for over 20% of the provincial labour force.

Table G-4. Employment in Forest Products and Other Industries

	1979	1980	1981	1982	1983
	(thousands of persons)				
Forest products					
Logging	25	25	20	17	20
Wood industries	51	50	47	40	40
Paper and allied industries	21	21	20	19	18
Subtotal	97	96	87	76	78
All other industries	1,047	1,117	1,183	1,128	1,119
Total	1,144	1,213	1,270	1,204	1,197

Sources: Canadian Forestry Statistics (Statistics Canada no. 25-202).
Historical Labour Force Statistics (Statistics Canada no. 71-201).
Employment, Earnings and Hours (Statistics Canada no. 72-002).

EXPORT

The forest products industry is heavily export oriented and is an important source of foreign exchange earnings for both British Columbia and Canada. It normally accounts for approximately 60% of the value of foreign exports. The composition of these exports for the period 1979 through 1982 is shown in Table G-5. Even in the recession year of 1982, exports totalled $4.6 billion which exceeded the value of mineral export products, the second most important group, by almost $1.9 billion.

Table G-5. Foreign Exports of British Columbia Products

	1979	1980	1981	1982
	(millions of dollars)			
Forest products				
Lumber	3,035	2,461	1,911	1,846
Pulp	1,498	1,898	1,709	1,520
Newsprint	486	530	526	567
Other forest products	677	769	704	669
Subtotal	5,696	5,658	4,850	4,602
Mineral products				
Coal	518	515	731	761
Natural gas	472	465	501	392
Aluminum ingots	341	442	404	332
Other mineral products	1,250	1,515	1,259	1,218
Subtotal	2,581	2,937	2,895	2,703
All other exports	1,236	1,059	1,408	1,451
Total	9,513	9,654	9,153	8,756

Source: Financial and Economic Review, Ministry of Finance.

GOVERNMENT REVENUE

The forest industry and its direct employees are an extremely important source of revenue to the provincial and federal governments. In 1981-82, the latest year for which complete statistics are available, the forest sector contributed an estimated $557 million to gross provincial government revenue. This represented approximately 10% of the total revenue of $5,551 million collected by the provincial government in 1981-82.

Table G-6 shows the distribution of provincial government revenue attributable to the forest sector. The stumpage and logging and provincial corporate income tax components are significantly affected by the cyclical variation in forest product markets. As a result, the forest sector's contribution to provincial government revenue exhibits considerable variation. During the period shown in the table, it ranged from a high of 21% in 1979-80 to a low of 10% in 1981-82.

Table G-6. Provincial Government Revenue From the Forest Sector

	1977-78	1978-79	1979-80	1980-81	1981-82
			(millions of dollars)		
Forest sector					
Stumpage	89	262	533	310	70
Other direct charges	16	21	32	30	30
Logging tax	48	51	44	46	12
Corporation capital tax	11	12	12	12	14
Timber & property tax	23	19	21	32	41
Corporate income tax	48	87	130	59	25
Personal income tax	98	120	134	157	214
Social services tax	87	81	79	89	138
Fuel tax	8	9	9	11	13
Total	428	662	994	746	557
Gross provincial revenue	2,979	3,386	4,692	4,697	5,551
Forest sector share (percentage)	14.4	19.6	21.2	15.9	10.0

Note: Gross provincial revenue excludes transfer payments from the federal government.

Source: Submission to the Royal Commission on the Economic Union and Development Prospects for Canada, COFI.

STRUCTURE OF THE FOREST PRODUCTS INDUSTRY

The four dominant sectors of the forest products industry are described here along with production trends since 1970.

THE LOGGING INDUSTRY

The logging industry is responsible for harvesting and transporting the logs that the manufacturing sectors process.

Table G-7 shows the provincial timber harvest for the period 1970 through 1983. The harvest exhibited an upward trend during the 1970's, with almost all the growth recorded in the interior. It did not expand smoothly due to the cyclical nature of forest product markets.

Table G-7. Provincial Log Production

Year	Coast	Interior (million cubic metres)	Total
1970	28.8	25.9	54.7
1971	28.4	28.2	56.6
1972	24.7	30.9	55.6
1973	32.7	37.4	70.1
1974	27.9	32.2	60.1
1975	21.4	28.7	50.1
1976	32.2	37.3	69.5
1977	28.6	41.4	70.0
1978	32.3	42.8	75.2
1979	30.6	45.6	76.2
1980	30.7	43.9	74.7
1981	23.2	38.6	61.8
1982	21.4	34.9	56.2
1983	26.8	44.6	71.4

Source: Ministry of Forests

As this table shows, provincial log production peaked at 76.2 million m^3 in 1979 and subsequently declined sharply through 1982 in response to a cyclical downturn in forest product markets. The future annual harvest is not expected to surpass the 75 million m^3 level on a regular basis because of allowable annual cut considerations.

Within the constraint of the allowable annual cut, the harvest level is largely dependent on the level of lumber production in the sawmill industry. As shown in Table G-8, approximately 80% of the harvest is normally destined for processing in sawmills. The plywood and pulp and paper industries absorb most of the remaining roundwood production. The pulp and paper industry relies heavily on the residual wood chips produced by sawmills and plywood mills to meet its wood fibre requirements.

Only a small fraction of the provincial harvest is not processed in British Columbia. This reflects the effect of the longstanding log export controls designed to encourage the development of the domestic processing industry.

Table G-8. Disposition of 1981 Provincial Log Harvest

Use	Millions of Cubic Metres	
Sawmills and planing mills	48.7	(1)
Plywood and veneer mills	4.4	(2)
Shingle mills	.8	(3)
Pulp and paper mills	6.1	(4)
Log exports	.9	(5)
Discrepancy	.9	(6)
Total harvest	61.8	(5)

Sources and Notes

(1) Sawmills and Planing Mills and Shingle Mills (Statistics Canada no. 35-204).

(2) Special tabulation based on data collected for Veneer and Plywood Mills (Statistics Canada no. 35-206).

(3) Calculated from industry shipments and squares/m³ conversion factor.

(4) Pulp and Paper Mills (Statistics Canada no. 36-204).

(5) Annual Report Statistical Supplement, Ministry of Forests.

(6) Derived residually. Reflects inventory change, timing differences, and other nonreported uses such as poles and pilings.

Interior log production first exceeded coastal production in 1972. The interior now accounts for approximately 60% of the total harvest. The species composition of the harvest differs markedly between the coast and the interior. Hemlock, cedar and balsam dominate on the coast, accounting for approximately 80% of the harvest; spruce and lodgepole pine dominate in the interior, accounting for approximately 70% of the harvest. In both the coast and interior regions, the species composition of the harvest has changed significantly through time as the industry has had to adapt to harvesting and processing what were originally considered less desirable species such as balsam and lodgepole pine.

Logging practices differ greatly between the coast and the interior. Operations are more mechanized in the interior where the terrain is gentler and the timber is smaller and more uniform in size and logging is generally carried out by independent contractors. On the coast, much of the logging is performed by the logging divisions of integrated forest product companies which control the cutting rights and have their own processing facilities.

The easier logging conditions contribute to lower wood costs in the interior, where logging costs are approximately one-half of those on the coast. The difference in wood costs has an adverse effect on the competitive position of the coast component. (Chapter H1 presents a comparison of international wood costs.)

On the coast, falling is done manually with chainsaws which are also used for limbing and bucking the timber to lengths suitable for transport. Cable logging systems are used to move the logs to roadside where they are loaded onto trucks using grapple loaders. Often the logs are trucked to water and then towed or barged to their final destination. Truck hauls are usually less than 50 kilometres but water transport distances may exceed 300 kilometres.

In the interior, more than 50% of the falling is done with mechanical tree shears. The trees are yarded out whole by skidders and then topped, limbed and loaded onto trucks with front-end loaders. Virtually all timber is hauled to the mill site by truck over distances usually less than 150 kilometres.

The transfer and exchange of logs is considerably more common on the coast than in the interior because of the low cost of water transport and the greater diversity of log species and grades produced. The most efficient utilization of the logs requires that they be sorted and directed to the type of mill best suited for processing them. An organized log market centred near Vancouver facilitates the purchase, sale and transfer of logs on the coast.

THE SAWMILL INDUSTRY

The sawmill sector is the mainspring of the forest products industry. Its roundwood requirements drive the logging industry and it provides the pulp and paper industry with raw material in the form of residual woodchips. (Sawmills produce over 90% of the provincial supply of residual woodchips.)

Table G-9 shows lumber production for the period 1970 through 1983. It shows the same upward trend observed in the interior harvest over this period. With its growth during the 1970's, interior sawmill capacity now greatly exceeds that on the coast. A record 8.9 billion board feet (fbm) of lumber was milled in the interior in 1983. This was more than double that sawn on the coast in 1983. Coast lumber production peaked at 4.8 billion fbm in 1978.

Table G-10 shows the distribution of 1983 sawmill capacity by mill size and region. While this information is subject to error due to the difficulties inherent in estimating mill capacities and the ongoing changes in the industry, it still indicates some of the industry's characteristics. It shows, for example, that the industry is dominated by large sawmills, defined as those having annual capacities in excess of 100 million fbm when operated on a two shift per day basis. While the 47 mills in this category only represent approximately one-quarter of the total number of sawmills, they account for almost one-half of total provincial lumber capacity. These large mills are concentrated in the Vancouver and Prince George regions but sawmills of various sizes are found throughout the province.

The coast and interior components of the sawmill industry differ significantly. The coast industry consists of a mixture of old and new mills, and produces a variety of lumber products including dimension lumber, boards, timbers and specialty lumber. This diversity is attributable partly to the relatively broad range of log sizes and species sawn and the different geographic markets the coast sawmills serve.

Table G-9. Provincial Lumber Production

Year	Coast	Interior	Total
		(million board feet)	
1970	3,790	3,867	7,657
1971	4,185	4,752	8,937
1972	4,027	5,479	9,506
1973	4,402	6,022	10,424
1974	3,403	5,339	8,742
1975	2,501	4,945	7,446
1976	3,988	6,639	10,627
1977	4,498	7,528	12,026
1978	4,796	7,736	12,532
1979	4,657	8,208	12,865
1980	4,247	7,707	11,954
1981	3,452	6,951	10,402
1982	3,002	6,917	9,919
1983	4,140	8,903	13,043

Sources: Sawmills and Planing Mills and Shingle Mills (Statistics Canada No. 35-204).
Production, Shipments and Stocks on Hand of Sawmills in British Columbia (Statistics Canada No. 35-003).

The old sawmills on the coast, which were designed to cut large, old-growth timber, have become increasingly inefficient as log sizes have declined. While some of these old mills have been replaced in recent years, others still remain in operation. The newer replacement mills have generally been designed to process smaller logs, in some cases as an integral part of the wood preparation process for a pulp and paper mill.

The majority of interior sawmill capacity is relatively new and incorporates equipment specifically designed to handle small logs. Mechanization and high speed throughput are emphasized in most interior sawmills that specialize in the manufacture of dimension lumber.

The coast sawmill industry faces significantly higher total costs than its interior counterpart. This cost differential reflects the higher delivered wood costs as well as generally higher milling costs. The problem is particularly acute for the older, less efficient mills. Unless these mills are replaced or modernized, further rationalization of the coast sawmill industry can be expected since only the newer, more efficient mills will be able to compete profitably in world markets.

THE PLYWOOD INDUSTRY

The plywood and veneer industry is the second largest component, in terms of wood volume used and value added, of the wood industries group after the sawmill industry. But in terms of employment and value added, it is only about one-fifth as important as the sawmill industry. (See page G-8 for the components of the wood industries group.)

Table G-10. Distribution of 1983 Sawmill Capacity

Resource Analysis Region	Number of Mills				Total Capacity
	Over 100 million fbm/yr	50-100 million fbm/yr	Under 50 million fbm/yr	Total	(million fbm/yr)
Cariboo	5	8	4	17	1,656
Kamloops	3	19	11	33	1,976
Nelson	2	9	12	23	1,233
Prince George (NE)	5	1	1	7	705
Prince George	10	11	10	31	2,695
Pr. Rupert (Coast)	1	1	0	2	216
Pr. Rupert (Int.)	4	1	7	12	960
Vancouver	17	23	26	66	5,245
Total Number	47	73	71	191	-
Total Capacity (million fbm/yr)	7,210	5,546	1,930	-	14,686

Source: Ministry of Forests

Table G-11 shows the provincial plywood production for the period 1970 through 1983. Production peaked in 1978 at approximately 2.5 billion square feet, measured on a 3/8-inch basis. The downward trend in production apparent since 1978 was halted in 1983, but this reversal is not expected to be permanent.

Table G-11. Provincial Plywood Production

Year	Production (million square feet, 3/8" basis)
1970	1,698
1971	1,874
1972	1,965
1973	2,197
1974	1,832
1975	1,786
1976	2,191
1977	2,343
1978	2,510
1979	2,323
1980	2,165
1981	1,923
1982	1,617
1983	1,992

Source: Construction Type Plywood (Statistics Canada no. 35-001)

As of June 1984, eight nonintegrated veneer mills and 16 plywood mills were operating in British Columbia. Five of the eight veneer mills peel veneer for lay-up at affiliated plywood facilities; the remaining three plants manufacture veneer for the open market. All the nonintegrated veneer mills are located in the interior.

As shown in Table G-12, estimated provincial plywood capacity as of June 1984 totalled approximately 2.1 billion square feet, 3/8 inch basis, and was divided almost equally between the coast and the interior. Plywood capacity has been reduced by approximately 600 million square feet, 3/8-inch basis, since the end of 1981 as five mills have been closed permanently.

These plant closures reflect the increased competition plywood faces in the structural wood panel market as well as the decreasing availability of logs suitable for peeling into veneer. Just as particleboard and hardboard eroded many of the traditional markets for sanded Douglas-fir plywood in the 1960's, waferboard is now making significant inroads into the structural panel market formerly dominated by sheathing grade plywood.

The growing success of waferboard in this market reflects its acceptance by builders as well as its inherent cost advantages over plywood. Waferboard operating costs are estimated to be at least one-third less than plywood. Moreover, because waferboard can be manufactured from poorer quality, less expensive species such as aspen, waferboard mills can be located close to major consuming regions. This provides waferboard producers with a transportation cost advantage relative to plywood mills which are obliged to locate where high-quality, peeler logs are available. The operating and transportation cost advantages enjoyed by waferboard producers have allowed them to compete successfully with plywood producers on the basis of price.

The competitive disadvantage is most severe for the coast segment of the British Columbia plywood industry. Like the sawmill sector, the plywood mills on the coast are generally older and less efficient than interior facilities. They also face significantly higher delivered wood costs. Three of the five plywood mill closures that have occurred since 1981 have been on the coast. In addition, one nonintegrated veneer mill on the coast closed permanently in 1983.

Table G-12. Distribution of Plywood Capacity as of June, 1984

Region	Number of Mills	Capacity (million square feet, 3/8" basis)
Coast	7	1,043
Interior	9	1,037
TOTAL	16	2,080

Source: Ministry of Forests

THE PULP AND PAPER MILL INDUSTRY

As shown in Table G-2, the pulp and paper mill industry dominates the paper and allied industries group. In terms of its contribution to value added in the forest products industry, the pulp and paper mill industry is approximately the same as the sawmill industry. It employs only about half as many persons as the sawmill industry. This apparent anomaly reflects the more capital-intensive nature of the pulp and paper mill industry.

Table G-13 shows pulp and paper production for the period 1970 through 1983. Production shows no discernible trend throughout the period except for the sharp decline in 1975, which resulted from the combined effects of an industry strike and a major economic downturn. Industry capacity expanded significantly in the early 1980's but market conditions have yet to allow it to be used fully. In 1983, for example, less than 75% of newsprint capacity was used.

The pulp and paper industry's dominant products are market pulp, primarily bleached softwood kraft (sulphate) pulp, and newsprint. Other products include mechanical pulp, dissolving and paper grade sulphite pulp, kraft paper, linerboard, fine paper, groundwood specialty papers, tissue and sanitary paper, and recycled paperboard.

As shown in Table G-14, there are 24 pulp and paper mills in British Columbia. Twelve of these mills are devoted exclusively to the production of bleached softwood kraft pulp. All but one of the mills with papermaking facilities are located on the coast. Newsprint is produced at four locations. All four of these mills are integrated operations producing both the mechanical and chemical (semi-bleached kraft pulp) furnishes required to make newsprint.

Table G-13. Provincial Pulp and Paper Production

Year	Total Pulp	Market Pulp Shipments	Total Paper and Paperboard	Newsprint
	(thousand tonnes)			
1970	4,099	2,513	1,674	1,192
1971	4,409	2,459	1,827	1,264
1972	4,576	2,886	1,834	1,315
1973	5,337	2,342	2,029	1,334
1974	5,267	3,382	1,952	1,297
1975	3,998	2,362	1,477	1,051
1976	5,320	2,927	1,977	1,327
1977	4,831	2,775	1,952	1,288
1978	5,426	3,239	2,137	1,379
1979	5,523	3,095	2,154	1,353
1980	5,783	3,324	2,147	1,321
1981	4,995	2,854	1,926	1,158
1982	4,938	2,662	1,858	1,199
1983	5,572	3,221	2,158	1,330

Sources: Pulp and Paper Mills, (Statistics Canada no. 36-204).
Canadian Pulp and Paper Association.

The coast segment of the pulp and paper industry is generally older than the interior segment. Major modernizations, currently underway at two of the older mills on the coast, Port Mellon and Woodfibre, are designed to improve efficiency and to expand capacity incrementally.

Other recently completed major projects in the industry include the following: the installation of new newsprint machines at Crofton, Duncan Bay and Powell River; the doubling of capacity at the Northwood bleached kraft pulp mill in Prince George; and the construction of a thermomechanical pulp mill in Quesnel.

The pulp and paper industry has become highly dependent upon the wood industries, especially sawmills, for its required supply of wood fibre. Wood residue, primarily wood chips and some sawdust, supplies approximately 80% of the fibre requirement. This reliance on wood residue is particularly pronounced in the interior pulp and paper industry; only one mill has roundwood chipping facilities.

The close relationship between the sawmill and pulp and paper sectors has been profitable to both industries. The sawmills (and plywood mills) have gained an additional source of revenue through the sale of wood residues which are less costly than chipping roundwood. This cost advantage can be expected to disappear, however, as the excess supply of residual wood chips is gradually eliminated as the pulp and paper sector expands. At the present time, much of the surplus supply of wood chips is exported under permit.

MARKETS FOR THE FOREST PRODUCTS OF BRITISH COLUMBIA

The size of the forest products industry and its significance to the provincial economy reflects the industry's successful penetration of international markets. Historically, the industry has been forced to look to foreign markets due to the small domestic market. Because of the distance to these foreign markets the industry has concentrated on standard commodities that can be marketed relatively easily and transported efficiently.

Most of the markets are highly competitive with the provincial industry having to accept prices set by world markets. In these circumstances, the industry's ability to sell profitably in world markets will continue to depend on its costs relative to those of competing suppliers.

British Columbia is a leading world exporter of forest products. In terms of value, its overall significance is indicated in Table G-15. (In Tables G-15, G-16, G-17, G-18 and G-19, trade and production statistics are based on three-year averages to minimize the effects of market cycles.)

Amongst countries, Canada is the largest single exporter of forest products accounting for nearly 20% of world trade. More than 40% of Canada's exports originate in British Columbia.

Table G-14. Distribution of Pulp and Paper Mills

Company	Mill Location	Annual Capacity Pulp (thousand tonnes)	Annual Capacity Paper (thousand tonnes)	Product
Belkin Packaging Ltd.	Burnaby	-	150	Recycled paperboard
B.C. Forest Prod. Ltd.	Crofton	657	436	Newsprint, bleached kraft pulp, groundwood specialty papers
B.C. Forest Prod. Ltd.	Mackenzie	200	-	Bleached kraft pulp
Canadian Forest Prod. Ltd.	Port Mellon	180	-	Bleached kraft pulp
Cariboo Pulp & Paper Ltd.	Quesnel	255	-	Bleached kraft pulp
Crestbrook Forest Ind. Ltd.	Skookumchuk	150	-	Bleached kraft pulp
Crown Forest Ind. Ltd.	Duncan Bay	770	510	Newsprint, bleached kraft pulp, kraft paper
Eurocan Pulp & Paper Co.Ltd.	Kitimat	300	300	Linerboard, kraft paper
Finlay Forest Ind. Ltd.	Mackenzie	178	-	Refiner mechanical pulp
Intercontinental Pulp Co.Ltd.	Prince George	219	-	Bleached kraft pulp
Island Paper Mills Ltd.	Annacis Island	-	112	Fine papers
MacMillan Bloedel Ltd.	Harmac	340	-	Bleached kraft pulp
MacMillan Bloedel Ltd.	Port Alberni	452	382	Newsprint, semi-bleached kraft pulp, groundwood specialty papers.
MacMillan Bloedel Ltd.	Powell River	670	620	Newsprint, semi-bleached kraft pulp, groundwood specialty papers
Northwood Pulp & Paper Ltd.	Prince George	500	-	Bleached kraft pulp
Pr. George Pulp & Paper Ltd.	Prince George	255	102	Bleached kraft pulp, kraft paper
Quesnel River Pulp Co. Ltd.	Quesnel	172	-	Thermomechanical pulp, bleached chemi-thermo-mechanical pulp
Scott Paper Ltd.	New Westminster	26	90	Tissue and sanitary papers
Tahsis Co. Ltd.	Gold River	230	-	Bleached kraft pulp
Westar Timber Ltd.	Castlegar	176	-	Bleached kraft pulp
Westar Timber Ltd.	Prince Rupert	369	-	Bleached kraft pulp
Western Pulp Ltd. Partnership	Port Alice	140	-	Dissolving and paper grade sulphite pulp
Western Pulp Ltd. Partnership	Squamish	150	-	Bleached kraft pulp
Weyerhaeuser Canada Ltd.	Kamloops	400	-	Bleached kraft pulp
TOTAL		6,789	2,702	

Note: Capacities are estimates for 1983. In the case of integrated mills, pulp capacity includes both pulp used internally to produce paper and market pulp (if any) shipped from the mill site as pulp.

Source: Ministry of Forests

Table G-15. World Exports of Forest Products
1979-1981 Average

(millions of U.S. dollars)

Country/Area	Roundwood	Lumber	Wood-based Panels	Wood Pulp	Paper and Paperboard	Total
Africa	680	148	97	201	90	1,215
Canada	151	2,914	268	3,040	3,848	10,221
British Columbia	115	2,093	112	1,442	608	4,370
United States	1,864	971	293	1,459	1,790	6,377
Latin America	54	428	185	486	301	1,454
Japan	6	35	84	47	668	839
Rest of Asia	2,818	1,395	1,421	22	252	5,908
Scandinavia	220	2,265	578	2,394	5,719	11,176
Rest of Europe	1,004	2,153	1,774	684	5,796	11,411
Oceania	273	90	35	128	169	696
USSR	814	975	179	289	351	2,608
World	7,883	11,374	4,914	8,749	18,983	51,904

Sources: *Yearbook of Forest Products, 1971-82*, FAO.
British Columbia Forest Industry Statistical Tables, COFI.

LUMBER

As shown in Table G-16, British Columbia accounts for approximately 9% of world softwood lumber production and 32% of world softwood lumber exports. The province is the world's most important exporter of softwood lumber. The USSR is the largest *producer* of softwood lumber, accounting for approximately 27% of world production but, in terms of exports, British Columbia is almost 3 times as important.

Table G-16. World Production and Exports of Softwood Lumber
1979-1981 Average

Country/Area	Production (thousand cubic	Exports metres)	Percentage of Production Exported (percent)
Africa	2,101	176	8
Canada	41,752	29,192	70
British Columbia	27,701	20,601	74
United States	60,445	4,405	7
Latin America	11,724	1,554	13
Japan	28,843	8	-
Rest of Asia	19,998	583	3
Scandinavia	22,497	12,814	57
Rest of Europe	45,897	8,660	19
Oceania	3,130	566	18
USSR	86,333	7,228	8
World	322,720	65,187	20

Note: Production and export statistics reflect the use of nominal dimension measurement for lumber in North America. This causes the statistics for Canada, British Columbia and the United States to be overstated by approximately 25% relative to production elsewhere in the world where lumber is measured on a solid wood basis.

Sources: Yearbook of Forest Products, 1971-82, FAO.
Sawmills and Planing Mills and Shingle Mills (Statistics Canada no. 35-204).
British Columbia Forest Industry Statistical Tables, COFI.

Table G-17 shows the major geographic markets served by British Columbia's sawmill industry. Despite efforts to diversify markets, the United States remains the dominant market for British Columbia lumber production normally absorbing 50 to 60% of provincial shipments. Offshore destinations, primarily Japan and the European Economic Community, usually account for approximately 20% of British Columbia lumber shipment; the remaining production is absorbed by the domestic Canadian market.

Table G-17. British Columbia Lumber Shipments

Destination	1979	1980	1981	1982	1983
		(million board feet)			
Canada	2,795	3,063	3,414	2,912	3,544
United States	7,726	6,326	5,263	5,169	7,203
United Kingdom	518	485	472	486	451
Other EEC	393	537	328	262	183
Japan	1,014	1,083	873	1,045	895
All Others	297	451	424	416	574
TOTAL	12,743	11,945	10,774	10,290	12,850

Source: British Columbia Forest Industry Statistical Tables, COFI.

The interior sawmill industry is heavily geared toward the production of dimension lumber used primarily in residential construction and is especially dependent upon the North American market. (Canada and the United States essentially comprise a common market for softwood lumber due to their shared lumber grades and the lack of tariffs or other barriers.) Approximately 95% of interior lumber production is consumed in Canada and the United States.

Despite its smaller size, the coast sawmill industry is generally responsible for approximately 75% of British Columbia's lumber shipments to overseas markets. In recent years, approximately 40% of coast lumber production has been shipped to offshore markets. This greater market diversification reflects a number of factors including tidewater locations which facilitate offshore shipments, and the decreasing competitiveness of the coast industry in the North American dimension lumber market.

The dominant North American market, which generally absorbs approximately 80% of British Columbia lumber shipments, is highly competitive. Prices are determined by supply and demand among many buyers and sellers, none of whom are sufficiently large relative to the total to be able to influence prices. Price volatility in this market is primarily attributable to the cycle in United States housing demand which, in turn, is closely linked to changing financial market conditions.

British Columbia sawmills compete in the North American market with producers in eastern Canada and the United States. United States' lumber production is concentrated in three regions: the Douglas Fir Region of the Pacific Northwest, the Western Pine Region of the western United States and the Southern Pine Region of the southeastern United States.

Although some are subject to assorted trade barriers, the other markets for British Columbia lumber also tend to be quite competitive. In offshore markets, British Columbia producers frequently encounter competition from other major lumber exporters such as Scandinavia, the United States and the USSR. There is also competition from domestically produced lumber in importing countries that have or are developing the forest resource necessary to support a local sawmill industry.

WOOD PULP

As shown in Table G-18, British Columbia accounts for approximately 4% of world wood pulp production and 16% of world wood pulp exports. The proportion of wood pulp exports to wood pulp production in British Columbia is high relative to most other areas as shown in this table. This reflects the comparative lack of forward integration into paper in the provincial pulp and paper industry. At 3.3 million tonnes, wood pulp exports by British Columbia are approximately equal to the volume of wood pulp exports by the United States and Sweden.

The production and export statistics shown in Table G-18 include all types of wood pulp. International trade in wood pulp, however, is presently dominated by chemical grades, primarily bleached (including semi-bleached) kraft pulp. Approximately 20% of world chemical pulp production is traded while only 5% of mechanical pulp production is traded.

During the period 1979-81, chemical pulps accounted for more than 80% of world pulp exports. In this same period, British Columbia accounted for approximately 24% of world exports of bleached (including semi-bleached) kraft pulp.

Table G-18. World Production and Exports of Woodpulp
1979-1981 Average

Country/Area	Production	Exports	Percentage of Production Exported
	(thousand tonnes)		(percent)
Africa	1,563	640	41
Canada	19,693	7,034	36
British Columbia	5,434	3,251	60
United States	46,253	3,113	7
Latin America	4,309	1,227	28
Japan	8,947	105	1
Rest of Asia	3,465	49	1
Scandinavia	17,519	5,536	32
Rest of Europe	12,951	1,582	12
Oceania	1,807	486	27
USSR	8,874	782	9
World	125,381	20,554	16

Sources: Yearbook of Forest Products, 1971-82, FAO.
Pulp and Paper Mills, (Statistics Canada no.36-204).
Canadian Pulp and Paper Association.

The most important market for British Columbia kraft pulp is western Europe which normally absorbs more than 40% of provincial shipments. As indicated in Table G-19, however, the markets for British Columbia kraft pulp are quite diversified with the United States and Japan being the other two major consuming regions.

Table G-19. British Columbia Kraft Pulp Shipments

Destination	1979	1980	1981	1982	1983
			(thousand tonnes)		
Canada	130	111	94	81	79
United States	845	745	626	647	808
Western Europe	1,390	1,483	1,258	1,136	1,253
Japan	570	650	465	477	525
All Others	374	407	435	401	652
TOTAL	3,309	3,396	2,878	2,742	3,317

Source: Canadian Pulp and Paper Association.

Unbleached kraft pulp is included in the shipments data in Table G-19 but this grade represents less than 5% of total kraft pulp shipments by British Columbia pulp mills. Both market and affiliated kraft pulp shipments are included in the table but the former category dominates, accounting for approximately 90% of total kraft pulp shipments by provincial mills.

British Columbia's kraft pulp mills compete primarily with market pulp producers in eastern Canada, the United States, Scandinavia and Brazil. When paper markets are soft, British Columbia market pulp producers may also encounter competition from integrated paper producers with surplus pulp to sell.

While northern bleached softwood kraft pulp is still regarded as a premium product for many end uses, changing technology has led to increased flexibility in the paper-making process. Consequently, British Columbia producers of bleached softwood kraft pulp must now compete increasingly with producers of other pulp grades, such as bleached hardwood kraft pulps, as well as with other producers of bleached softwood kraft pulp. The other grades typically trade at less than northern bleached softwood kraft pulp; this price differential provides papermakers with an incentive to economize on the use of northern bleached softwood kraft pulp in their products.

NEWSPRINT

As shown in Table G-20, British Columbia accounts for approximately 5% of world newsprint production and 9% of world newsprint exports. Canada is the leading world producer and exporter of newsprint. Approximately 63% of world newsprint exports originate in Canada. Unlike softwood lumber and wood pulp, however, Canadian newsprint exports originate primarily in eastern Canada.

Table G-20. World Production and Exports of Newsprint
1979-1981 Average

Country/Area Exported	Production	Exports	Exports as % of Production
	(thousand tonnes)		
Africa	271	133	49
Canada	8,760	7,824	89
British Columbia	1,279	1,106	86
United States	4,111	156	4
Latin America	497	64	13
Japan	2,616	111	4
Rest of Asia	1,518	51	3
Scandinavia	3,752	3,234	86
Rest of Europe	2,642	391	15
Oceania	526	228	43
USSR	1,473	315	21
World	26,166	12,510	48

Sources: Yearbook of Forest Products, 1971-82, FAO.
Canadian Pulp and Paper Association.

Table G-21 shows the principal markets for British Columbia newsprint, including groundwood specialty papers. Groundwood specialty papers, which command a significant price premium over standard newsprint, consist of a variety of upgraded newsprint-type papers such as telephone directory paper. Their volume has been increasing in recent years as older newsprint machines are being converted to the production of these higher valued papers. According to Canadian Pulp and Paper definitions, British Columbia shipments of such papers averaged approximately 70,000 tonnes during the period 1979-83.

The dominant market is the United States which normally consumes approximately two-thirds of provincial newsprint shipments. The remaining production is divided almost equally between the domestic Canadian and offshore markets. Unlike pulp, however, British Columbia newsprint exports to Europe are negligible as this market is served by the large newsprint industry in eastern Canada which enjoys a significant transportation cost advantage over the British Columbia industry.

Table G-21. British Columbia Newsprint Shipments

Destination	1979	1980	1981	1982	1983
			(thousand tonnes)		
Canada	180	201	190	202	185
United States	970	925	796	821	1,007
Europe	5	10	5	7	
Asia/Oceania	181	164	144	155	246
All Others	74	84	71	57	----
TOTAL	1,410	1,384	1,206	1,242	1,438

Notes: Includes shipments of groundwood specialty papers.
A complete breakdown of 1983 newsprint shipments by destination is not available.

Source: Canadian Pulp and Paper Association.

British Columbia newsprint shipments to the United States are concentrated in the western states. In this market, competition comes primarily from newsprint mills in the U.S. Pacific Northwest, but occasionally from producers in eastern Canada and Scandinavia. In offshore markets, British Columbia newsprint mills also compete with these producers as well as mills located in such countries as New Zealand and Japan.

PLYWOOD

As shown in Table G-22, British Columbia is responsible for approximately 5% of world plywood production and 6% of world plywood exports. The Canadian plywood industry is centred in British Columbia, which accounts for more than 80% of total Canadian plywood production. The United States is the world's leading producer accounting for slightly less than 40% of world plywood production.

Unlike lumber, kraft pulp and newsprint, British Columbia plywood production is largely destined for consumption within Canada. As indicated in Table G-23, this consumption amounts to approximately 75%. The principal offshore market for British Columbia is the European Economic Community which absorbs approximately 20% of British Columbia plywood shipments. Most of this goes to the United Kingdom. Plywood exports to Japan have increased significantly in recent years but in 1983 still amounted to less than 2% of total shipments.

Table G-22. World Production and Exports of Plywood
1979-1981 Average

Country/Area	Production	Exports	Percentage of Production Exported
	(thousand cubic metres)		
Africa	416	64	15
Canada	2,119	483	23
British Columbia	1,891	437	23
United States	16,095	315	2
Latin America	1,467	191	13
Japan	7,876	121	2
Rest of Asia	6,628	3,953	60
Scandinavia	736	547	74
Rest of Europe	2,843	912	32
Oceania	155	39	25
USSR	2,015	319	16
World	40,351	6,943	17

Sources: Yearbook of Forest Products, 1971-82, FAO
British Columbia Forest Industry Statistical Tables, COFI.

Table G-23. British Columbia Plywood Shipments

Destination	1979	1980	1981	1982	1983
	(million square feet, 3/8" basis)				
Canada	1,806	1,658	1,543	1,235	1,547
United Kingdom	198	211	207	184	214
Other EEC	290	319	174	190	173
Japan	8	30	20	22	28
All Others	5	12	9	23	26
TOTAL	2,307	2,230	1,953	1,654	1,988

Source: British Columbia Forest Industry Statistical Tables, COFI.

In contrast to the single North American lumber market, the plywood markets in Canada and the United States are quite distinct. British Columbia plywood exports to the United States have never been significant partly because of different product standards and a 20% tariff. Canada, in turn, imposes a 15% duty on imports from the United States.

Under the Tokyo Round of the Multilateral Trade Negotiations under the General Agreement on Tariffs and Trade concluded in 1979, Canada and the United States agreed to reduce their respective tariffs on softwood plywood to a common rate of 8%, provided product standards could be harmonized. To date, however, little or no progress has been achieved in establishing common standards.

In the dominant Canadian market, British Columbia plywood producers compete with eastern Canadian plywood mills and increasingly with waferboard plants located in the other provinces. In offshore markets, United States plywood mills provide the major source of competition. Despite the tariff, United States mills also occasionally provide significant competition in the Canadian market when the United States panelboard market is depressed.

SECTION H

ECONOMIC TRENDS AND OPPORTUNITIES

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CHAPTER H1

TRENDS IN ECONOMIC CONDITIONS AND MARKETS

COMPETITIVE POSITION OF THE BRITISH COLUMBIA FOREST PRODUCTS INDUSTRY

As the preceding section has shown, the British Columbia forest products industry is dependent on foreign markets for its size and financial well-being. Overall, approximately three-quarters of the value of shipments by the provincial forest industry are derived from export sales.

In competitive markets such as the lumber market, where similarly priced substitute products are available, a unilateral attempt to increase the price above the prevailing level would cause the customer to seek out another supplier. So, despite British Columbia's importance as a major world supplier of forest products, its companies individually are generally incapable of influencing selling prices in most foreign markets, and thus cost increases cannot be passed along unilaterally to the consumer. The industry's short-term profitability and longer-term financial viability is critically dependent on keeping its production costs comparable to those of its competitors.

This section examines the recent competitive position of the forest industry in terms of delivered wood cost, that is, the cost of wood (sawlogs, pulp wood, wood chips) delivered to the mill site. In the case of roundwood, this cost includes the following elements:

- stumpage (the price of standing timber)
- cost of logging to roadside
- cost of loading and transporting to mill site
- roads
- overhead.

Wood costs in British Columia are compared to those in eastern Canada, Finland, Sweden, the southern United States and Brazil. Eastern Canada, Finland and Sweden represent traditional competitors for the British Columbia industry while Brazil and the southern United States are becoming increasingly important world suppliers of forest products.

IMPORTANCE OF WOOD COSTS

Table H-1 shows how significant delivered wood costs are in determining the manufacturing costs in the forest products industry. Although the data are somewhat out of date, they do indicate that wood costs represent the single most important cost element in the production of lumber, kraft pulp and newsprint in British Columbia.

Table H-1. Composition of Manufacturing Costs in the British Columbia Forest Products Industry 1980

	Lumber		Bleached Kraft Market Pulp		Newsprint
	Coast	Interior	Coast	Interior	
	($/thousand board feet)		($/air-dried tonne)		($/finished metric tonne)
Wood	149	89	192	118	110
Other Materials	25	21	87	79	73
Energy	4	7	32	23	37
Labour	74	54	54	43	71
Administration	26	18	44	44	45
Depreciation	7	8	13	20	17
Total	285	197	422	327	353

Source: Forest Products Industry British Columbia Regions - Manufacturing Cost Update, Sandwell Management Consultants Limited.

The relative importance of wood costs in 1980 ranged from a high of 52% for coast sawmills to a low of 31% for newsprint mills. The latter figure is actually slightly understated as it does not include the wood cost implicit in the chemical pulp furnish used in the manufacture of newsprint. The wood cost data for lumber are net of the residual wood chip revenue. The comparable gross wood costs are $213 per thousand board feet and $122 per thousand board feet for coast and interior sawmills respectively. The significant difference in wood costs between coast and interior kraft pulp producers is largely a result of much lower chip prices in the interior in 1980.

While delivered wood costs are a primary determinant of the industry's competitive position, they are still only one component of manufacturing costs. So, the future competitive position of the British Columbia forest products industry will depend, not just on the evolution of delivered wood costs, but also on changes in the other cost elements identified in Table H-1.

Unfortunately, a recent comprehensive comparison of international costs for the manufacture of forest products is currently unavailable. The Forest Industries Advisory Committee (established by the federal government and consisting of representatives from industry and labour) is conducting an analysis of international manufacturing costs for lumber, kraft pulp and newsprint. Results are not expected until late 1984 at the earliest.

TRENDS IN INTERNATIONAL WOOD COSTS

Tables H-2 and H-3 summarize trends in wood costs in Brazil, British Columbia, eastern Canada, Finland, Sweden and the southern United States during the period 1971 to 1982. Table H-2 presents typical costs of softwood sawlogs at the mill while Table H-3 presents comparable data for softwood pulp wood.

Brazil is not included in Table H-2 because little sawlog wood is presently produced from its softwood plantations. Similarly, sawlog cost data for eastern Canada are shown only for the years 1977 to 1982 because until recently, forest operations in eastern Canada have been heavily oriented toward the production of pulp logs. In Table H-3, pulp log costs are shown for all regions except British Columbia, where residual wood chip costs are used because of the province's limited harvest of pulp logs.

Table H-2 shows that sawlog costs increased substantially in all regions of the world during the period 1971 to 1982 but that the rate of increase varied significantly among the regions. The largest increase was recorded on the British Columbia coast where costs increased by almost 300%. In contrast, the British Columbia interior remained the lowest cost producer of sawlogs during this period, experiencing a cost increase of only 85%. By 1980, sawlog costs on the British Columbia coast were more than double those of the interior.

Currency depreciation in the 1980's offset, in terms of U.S. dollars, much of the increase experienced in Scandinavian sawlog costs during the 1970's. The devaluation of the Swedish krona (Skr) was especially pronounced, declining by approximately 80% from Skr 4.23 per U.S.$ in 1980 to Skr 7.67 per U.S.$ in 1983. As noted in Table H-2, the continued devaluation of the Skr in 1983 has moved Swedish sawlog costs below those of the British Columbia coast.

Large currency movements such as this can clearly have a substantial effect, at least in the short term, on the relative competitive positions of different forest products producers. The longer-term effect, however, depends on whether domestic costs, especially wages, rise in response to the reduction in the standard of living implicit in a currency devaluation.

Table H-3 shows the increase in softwood pulp wood costs since 1971. Wood chip costs in the British Columbia interior have remained competitive with pulp log costs in Brazil and the U.S. south. Coast wood chip costs, however, increased more rapidly during the period 1971 to 1982 and now are comparable to pulp log costs in eastern Canada and Sweden (after allowing for devaluation).

COMPOSITION OF INTERNATIONAL WOOD COSTS

Table H-4 shows the estimated composition of 1982 wood costs for Brazil, British Columbia, eastern Canada, Finland, Sweden and the U.S. south. Pulp log costs (corresponding to Table H-3) are shown for Brazil and eastern Canada. Sawlog costs (corresponding to Table H-2) are shown for the remaining regions. The cost breakdowns for Sweden and Finland reflect 1982 exchange rates.

Table H-2. Typical Costs of Softwood Sawlogs Delivered to Mill

Region	1971	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
						(U.S.dollars/m^3)					
British Columbia											
Coast	11.30	18.20	22.00	25.00	26.30	27.50	27.50	35.00	42.60	41.90	44.30
Interior	10.70	13.60	16.00	16.90	17.40	16.30	15.20	22.10	20.80	20.70	19.90
Eastern Canada						23.90	23.50	23.30	23.60	29.80	31.90
Finland	19.70	39.50	53.40	47.70	47.40	49.10	44.20	51.30	64.60	62.70	58.10 (49.70)
Sweden	17.30	25.10	38.60	42.70	48.20	51.90	52.10	55.60	61.40	52.30	44.50 (35.80)
U.S. South	16.00	22.40	23.70	22.00	26.20	28.60	33.60	38.50	38.50	39.40	37.00

Note: Figures in parentheses represent 1982 costs for Finland and Sweden expressed at average 1983 exchange rates.

Source: Availability and Cost of Wood in Major Forest Product Regions 1970-1990, Jaakko Poyry Interforest.

Table H-3. Typical Costs of Softwood Pulpwood at the Mill

Region	1971	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
					(U.S.dollars/m³)						
Brazil	8.40	11.60	15.00	16.30	14.20	15.20	16.80	17.10	18.50	18.00	17.50
British Columbia											
Coast	10.50	13.00	17.20	20.00	19.40	17.90	16.30	19.40	33.60	33.30	31.10
Interior	7.50	8.00	9.50	16.30	15.80	14.30	12.00	12.40	17.90	16.40	17.10
Eastern Canada	12.20	14.70	18.70	20.00	22.60	23.70	22.70	22.40	23.50	2[illegible].70	29.20
Finland	14.90	22.10	35.50	41.30	45.20	43.90	38.20	39.40	48.30	50.50	49.30 (42.20)
Sweden	15.80	19.60	27.30	35.90	40.50	40.50	38.20	40.10	43.50	47.00	42.30 (34.00)
U.S. South	9.90	11.50	13.90	15.50	15.50	16.20	17.00	19.70	20.60	20.40	20.80

Note: Figures in parenthesis represent 1982 costs for Finland and Sweden expressed at average 1983 exchange rates.

Source: Availability and Cost of Wood in Major Forest Product Regions 1970-1990, Jaakko Poyry Interforest.

Table H-4. Estimated Composition of 1982 Wood Costs at the Mill

	Overhead	Roads	Transport	Logging	Stumpage	Total
	(U.S. dollars/m³)					
Brazil	3.00		4.50	2.50	7.50	17.50
British Columbia						
Coast	17.00	5.00	12.00	7.50	3.00	44.50
Interior	4.00	1.50	6.50	7.00	1.00	20.00
Eastern Canada	3.00	4.00	4.00	15.50	2.50	29.00
Finland	3.50		8.00	10.00	36.50	58.00
Sweden	2.00		7.00	13.00	22.50	44.50
U.S. South	1.00	1.00	4.00	7.50	23.50	37.00

Notes:

(1) Pulp log costs are shown for Brazil and eastern Canada. Sawlog costs are shown for the other regions.

(2) Cost accounting practices vary between the regions and operations considered. The cost figures have been standardized as far as possible. The components are defined as follows:

a) Overhead - This cost includes a variety of items related to organization, management and miscellaneous support activities. Common cost items included are: head office administration, district administration, camps, crew transportation, equipment maintenance, buildings, insurance and taxes. Some of these items are sometimes included as part of the logging and transport cost components.

b) Roads - This includes the cost of road maintenance and capital charges for road construction (depreciation and interest). In Finland and Sweden, the cost of permanent roads is paid for by the forest owner and is often included in the stumpage cost.

c) Transport - This represents the cost for transport to the mill site which includes loading, transport, storage and processing (if any) between the roadside and the mill gate as well as direct transport overhead costs.

d) Logging - This includes the costs for felling and wood processing in the stand plus terrain transportation to roadside, construction of landings and minor logging roads as well as direct logging overhead.

e) Stumpage - This is the payment made for the right to cut wood in a forest stand. This payment should cover all costs required to produce wood to be harvested, including long-term profit to the landowner. Stumpage payment practices differ considerably among regions.

Source: Availability and Cost of Wood in Major Forest Product Regions 1970-1990, Jaakko Poyry Interforest.

Some of the major factors affecting wood costs in the different regions are as follows.

Brazil: Stumpage costs are a relatively high proportion of wood costs due to the investments required for land acquisition, site preparation, silvicultural treatments and infrastructure. In many cases, however, stumpage costs are subsidized with tax incentives.

Logging costs are relatively low due to low labour costs but this is partially offset by the investment and operating costs of loading and transport equipment. Transportation is a significant factor because some of the plantations are a long way from the mills. Virtually all of the present operations in the pine plantations are thinnings, so tree sizes are small.

British Columbia: The large volumes per hectare, large tree sizes especially on the coast and low stumpage fees have a positive effect on costs. Negative cost factors include high labour costs, long transport distances and difficult terrain on the coast. Camps are frequently required for remote logging operations on the coast and are major contributors to the high overhead cost shown in Table H-4.

Eastern Canada: The low stumpage fees for timber from provincial forests have a positive effect on costs. Small tree size, long transport distances and lack of infrastructure, especially in the northern regions of Ontario and Quebec, have a negative effect.

Finland: High stumpage fees are demanded by private forest owners in southern Finland. Higher logging transportation costs in northern Finland tend to offset the lower stumpage fees on government owned forest land. Small tree sizes and the large proportion of the annual harvest that comes from thinnings have a negative effect on logging costs.

Sweden: The forest industry is dependent on wood from private forest owners. The demand and supply situation is similar to Finland but the wood cost level is somewhat lower. The high wood costs are primarily due to the high logging costs.

U.S. South: Stumpage fees vary throughout the U.S. South but generally can be considered moderate. The private forest owners, from whose land 60-70% of the annual volume is harvested, are unorganized. Logging conditions generally are good although special equipment is sometimes required for marshy areas. Transportation conditions and transport distances to the mills are quite favourable.

FUTURE DEMANDS FOR FOREST PRODUCTS

The dependence of British Columbia's forest products industry on international markets documented in Section G will undoubtedly continue and, consequently, growth in world demand for forest products will significantly influence future opportunities in the provincial industry. The long-term prospects for such growth are examined here.

This review is based largely on information from public sources such as Interim Report of the Forest Industries Advisory Committee (August '83) and the Canadian Pulp and Paper Association's Submission to the Royal Commission on the Economic Union and Development Prospects for Canada. Emphasis is placed on the products and markets that have historically been important to the British Columbia industry.

World-wide forest product requirements are expected to increase in the coming years but this growth is not forecast to be as rapid as it was before the economic disruptions of the 1970's. Recent demand projections are significantly less optimistic than those made in the late 1970's because of a general slowing in the rate of world economic growth and changing demographics in many of the major western industrialized economies. A slow growth rate can be expected to be accompanied by increasing competition for sales among supplying regions.

The ability of the British Columbia forest products industry to capitalize on the market opportunities during this slow growth will depend critically on its cost competitiveness in world markets.

LUMBER

World softwood lumber consumption is forecast to increase slowly to the year 2000. Much of the expected growth will reflect a recovery from the cyclical low in world consumption recorded in 1982. Between 1978 and 1982, apparent world consumption of softwood lumber declined by 14%, or 48 million m^3. Approximately 60% of this precipitous decline was attributable to decreased demand in the United States, especially in its residential construction industry.

When measured from its 1978 peak, world softwood lumber consumption is expected to increase by less than 1% per year. In comparison, apparent softwood lumber consumption grew by 1.7% per year in the period 1960 to 1970. This expected slow growth will compel high cost producers to rationalize non-competitive capacity and to extract the maximum value from the resource.

The longer-term demand prospects facing the British Columbia sawmill industry in its major markets are as follows:

United States: The lumber demand in the United States is heavily influenced by housing starts. Table H-5 shows the historical importance of new residential construction in lumber consumption, especially for single family dwellings. During the period 1975 to 1983, new residential construction accounted for 36% of the consumption.

The short-term cycle in lumber demand evident in the table is largely attributable to the swings in home building activity. These swings result primarily from the sensitivity of housing demand to changes in interest rates and can be expected to continue in the future.

The longer-term demand for housing is largely determined by demographic factors, especially household formations. Household formation is forecast to begin to fall sharply by the later 1980's reflecting the 20-year earlier transition from the baby boom of the 1950's and early 1960's to the baby bust of the late 1960's and early 1970's.

The impact of this change on housing starts will be delayed somewhat by the pent-up demand resulting from the financially induced low levels of construction experienced in the early 1980's. The net effect, however, will be a gradual decline in the underlying rate of housing demand in the United States. Housing starts are expected to decline from an annual average of 1.77 million units in the 1970's to approximately 1.45 million units in the 1990's. Declining lumber consumption in housing construction will be offset by slow growth in the other categories shown in Table H-5.

Total lumber consumption is forecast to average approximately 38 billion board feet (fbm) in the 1990's compared to 36.3 billion fbm in the 1970's. The previous cyclical peak of 41.29 billion fbm established in 1978 is not expected to be surpassed before the late 1980's. The reduced relative importance of new residential construction in lumber demand should tend to dampen the dramatic swings in United States lumber consumption that have occurred in the past decade.

Canada: Demographic factors similar to those in the United States are expected to cause a downward trend in the demand for housing in Canada. Housing starts are forecast to average approximately 170,000 units per year in the 1990's compared to 234,000 units in the 1970's. Growth in demand in other end uses is expected to generate a slow increase in total lumber consumption. Consumption in the 1990's is expected to average approximately 6.6 billion fbm compared to a previous peak of 5.9 billion fbm consumed in 1981.

European Economic Community: Softwood lumber consumption is forecast to recover from the recession levels of the early 1980's but overall growth in this mature market is expected to be minimal. In the period 1981-82, apparent softwood lumber consumption averaged 35.1 million m^3 compared to 39.5 million m^3 in 1980. Over the next decade, softwood lumber consumption is not expected to reach the peak of 42.7 million m^3 set in 1973.

Japan: Demographic trends in Japan are even less favourable than in the United States; this is expected to have a pervasive effect on Japanese lumber demand through the year 2000. Household formation is expected to decline and the housing boom of the 1970's will not be repeated. Housing starts, which averaged 1.54 million units per year in the 1970's, are expected to decline to 1.3 million units per year in the 1990's. The share of wooden housing starts will also decrease relative to the early 1970's reflecting the increasing urbanization of Japan. Softwood lumber demand is forecast to average approximately 26 million m^3 per year in the 1990's compared to almost 30 million m^3 in the 1970's.

MARKET PULP

To a significant extent, growth in world demand for market pulp will be determined by the trend in world consumption of paper and paperboard. Market pulp currently accounts for approximately 40% of the white chemical pulps used for paper making. These white chemical pulps, which consist of bleached and semi-bleached kraft (sulphate) pulp and unbleached and bleached sulphite pulp, represent approximately 40% of world wood pulp production. The remaining 60% are dominated by mechanical pulps and unbleached kraft (non-white chemical) pulp. Unlike white chemical pulps, these pulps are chiefly produced and consumed in integrated pulp and paper mills.

Table H-5: Composition of United States Lumber Demand

End Use	1975	1976	1977	1978	1979	1980	1981	1982	1983
				(billion board feet)					
New Residential Construction									
Single Family	9.30	12.47	15.50	15.37	12.49	8.54	7.16	6.68	10.90
Multifamily	1.07	1.44	2.09	2.33	2.23	1.77	1.68	1.48	2.34
Total	10.37	13.91	17.59	17.70	14.72	10.31	8.84	8.16	13.24
Mobile Homes	.56	.68	.76	.81	.82	.65	.69	.70	.91
Nonresidential Construction	3.97	3.78	4.15	4.83	4.88	4.31	4.47	4.30	4.39
Industrial Consumption	9.69	10.92	11.33	11.77	12.10	11.13	11.24	10.53	10.77
Residential Repairs & Alterations	5.73	6.05	5.96	6.18	6.27	6.28	6.10	6.00	6.30
TOTAL	30.30	35.33	39.79	41.29	38.78	32.68	31.34	29.68	35.60
U.S. Private Housing Starts (million units)	1.16	1.54	1.96	2.00	1.72	1.30	1.10	1.06	1.70

Source: FORSIM Review, Data Resources, Inc. 1984

Growth in world paper and paperboard demand has slowed significantly in the past two decades. In the period 1970 to 1980, apparent world consumption increased by only 3.0% per year compared to 5.7% in the previous decade.

This reduction is attributable to two factors. First, the rate of world economic growth slowed in the 1970's and this affected the demand for most products including paper and paperboard. Second, certain paper and paperboard products encountered increasing competition from substitute products during the 1970's. This was especially true in packaging where kraft papers lost some of their market share to plastics.

The decline in the rate of growth of world paper and paperboard demand is expected to moderate: world demand for paper and paperboard is expected to increase by approximately 2.5% per year in the period 1980-1995.

This forecast falls into the mid-range of the recent demand projections for paper and paperboard shown in Table H-6. It assumes that substitution of plastics for paper and paperboard in the packaging market will slow and that the net impact of the electronics revolution on paper consumption will be positive until the 1990's.

Table H-6. Forecasts of World Demand for Paper and Paperboard

Forecast	Date of Forecast	Period of Forecast	Annual Growth Rate
FAO Industry Working Party	1977	1980-90	3.6%
Predicasts Inc.	1983	1981-95	3.6%
Data Resources, Inc.	1983	1983-92	3.1%
Jaakko Poyry	1982	1978-95	3.2%
P. Graff-Feldmuhle	1983	1980-95	1.5%

The demand for market pulp that will arise from the projected growth in world paper and paperboard consumption cannot be forecast with certainty due to a number of conflicting trends, but it is virtually certain to increase.

In certain regions such as Japan, some other Asian countries and possibly some countries in Europe, market pulp is expected to comprise a larger percentage of the furnish for making paper as limitations on local wood supply develop. In others, especially the large United States market, further integration of pulp and paper manufacturing is expected to reduce the importance of market pulp.

In western Europe, the largest consumer of market pulp, demand prospects are clouded because Scandinavian paper mills have, since the beginning of 1984, enjoyed duty-free access to the European Economic Community. This significant change in tariff structure could spur increased finished paper exports to the European Economic Community from Scandinavia. Such a structural change would have a negative effect on market pulp demand in the European Economic Community because the finished paper imports would displace paper traditionally produced in the Community from market pulp.

Market pulp demand may also change in the future due to the recent development of new kinds of chemical-mechanical pulps. These pulps have a number of the qualities found in higher grade chemical pulps, especially bleached kraft pulp which presently dominates world trade in market pulp, but they yield more pulp per unit of wood processed and are less costly to produce. The impact of this changing technology on future market pulp demand is difficult to predict but the favourable economics of chemical-mechanical pulps suggest they are likely to become more important in the future as they gain market acceptance.

NEWSPRINT

Newspaper publishing can be characterized as a mature industry in the western industrialized countries of the world. In these countries, newspapers probably achieved full penetration of potential markets some years ago. Therefore, further growth in newsprint consumption will depend on population growth, household formations and advertising expenditure, which is closely linked to real economic growth. The potential for growth is much better in many of the newly industrialized and developing countries of Asia and Latin America where newspaper market penetration will likely increase as real per capita income rises.

Newsprint consumption, especially in the western industrialized countries, may be adversely affected in the longer term by increased competition from electronic communications. Technology now exists for distributing a wide variety of information through electronic networks. Information such as classified advertisements, schedules and timetables, and telephone directories will be prime targets for early application of these systems. However, so far these systems have had little commercial impact and their adoption is expected to proceed slowly. It is generally predicted that they will begin to have a negative impact on newsprint consumption in the 1990's.

World newsprint consumption is forecast to grow by approximately 2.0% per year in the period 1980 to 1995. This is slightly below the annual rate of 2.7% recorded in the period from 1970 to 1980 and significantly less than the rate of 4.4% per year achieved in the previous decade. (The growth rate for the period 1970 to 1980 has been adjusted to reflect the reduction in the standard basic weight of newsprint which occurred in the mid-1970's.)

As indicated in Table H-7, the forecast annual growth of 2.0% is in the mid range of recent projections for world newsprint consumption. The more conservative forecasts in this table generally assume that electronic alternatives to daily newspapers will be adopted more rapidly.

PLYWOOD

In contrast to lumber, market pulp and newsprint, the principal market for British Columbia plywood is Canada which absorbs approximately 75% of provincial plywood shipments. This heavy reliance upon the domestic market is expected to continue.

Table H-7. Forecasts of World Demand for Newsprint

Forecast	Date of Forecast	Period of Forecast	Annual Growth Rate
FAO Industry Working Party	1977	1980-90	2.5%
Predicasts Inc.	1983	1981-95	3.3%
Data Resources, Inc.	1983	1983-92	2.9%
Jaakko Poyry	1982	1978-95	2.2%
P. Graff-Feldmuhle	1984	1980-95	.6-.7%

As a result, future demand for plywood will be largely determined by growth in demand for structural panelboards in Canada and the ability of the British Columbia plywood sector to compete with producers of other structural panelboards (waferboard and oriented strandboard) for a share of the domestic market.

Structural panelboard demand in Canada is forecast to increase relatively strongly to the year 2000. Consumption is expected to average approximately 3.2 billion square feet, 3/8 inch basis, per year during the 1990's compared to 2.5 billion square feet, 3/8 inch basis, during the period 1975-79. This growth will be concentrated in industrial end uses reflecting the expected weakness in Canadian housing starts to the year 2000.

The share of the structural panelboard market captured by the British Columbia plywood industry is forecast to decline significantly throughout this period reflecting its poor competitive position relative to the waferboard industry. As waferboard capacity expands in the United States, Canadian waferboard mills are expected to look increasingly to the Canadian market for sales.

Similarly, overseas markets for plywood do not appear overly promising. Exports to Europe are unlikely to surpass their 1980 peak. Competition from waferboard is likely to pick up in the future, both from exports as well as from panels produced in Europe itself.

CHALLENGES AND OPPORTUNITIES FACING THE BRITISH COLUMBIA FOREST PRODUCTS INDUSTRY

World demand for forest products is forecast to increase to the year 2000, albeit at a slower rate than recorded in the 1960's and early 1970's. Real price increases will be limited by the slow growth in demand and this will keep pressure on high cost producers to phase out non-competitive capacity.

The ability of British Columbia's forest products industry to capitalize on the opportunities that will arise from the growth in world demand for forest products will be affected by resource constraints and the international competitive position of the provincial industry.

In the past, the growth of the provincial industry has been propelled by increasing the harvest of the standing merchantable stock of high-quality, old growth timber. During the 1970's, most of this increase occurred in the interior of the province where the harvest grew from 25.9 million m³ in 1970 to 45.6 million m³ in 1979 as interior lumber production more than doubled to 8.2 billion fbm. The expansion in the sawmill sector also created an abundant supply of residual wood chips which provided the interior pulp and paper mills with an economical source of wood fibre.

The growth pattern of the past cannot be expected to continue as the physical limits of the economically harvestable stock of old growth timber are now in sight. The provincial timber harvest cannot be increased significantly without incurring heavy costs in the form of future wood supply deficits. As a consequence, future growth in the British Columbia forest products industry will have to come increasingly from adding value to the products manufactured rather than increasing the volumes produced.

The mature forest left to be harvested over the next four to five decades is less valuable than what has been harvested in the past. If the current rate of harvest of approximately 75 million m³ per year is to be maintained in British Columbia, less desirable species will have to be harvested in larger volumes and logs will be generally smaller and of poorer quality. Other things being equal, the move into poorer quality and more remote timber can be expected to lead to increasing delivered wood costs which, as discussed earlier, are a major determinant of manufacturing costs in the forest products industry.

The adverse effect of rising wood costs on competitive position is already apparent on the coast where sawmills continued to take downtime in 1983 and 1984 despite the recovery in the United States housing market. Control of logging costs, especially on the coast, is crucial if British Columbia's competitive position is to be maintained or improved.

Section J presents the findings of four reports which relate to the future of British Columbia's forest industry. A report by the Sterling Wood Group analyzes the wood cost and other problems facing the coast segment of the forest products industry and its prospects for the future. This report concludes that some further contraction of the coast industry is probable unless external factors, such as exchange rates, change in the industry's favour. The restructuring is expected to be confined to the lumber and plywood sectors but marginal, higher cost pulp mills could also be affected since the cost of wood fibre will increase as the supply of residual woodchips is reduced by further sawmill and plywood mill closures.

British Columbia is not alone in facing a resource constraint. Other areas such as the United States Pacific Northwest and Scandinavia are facing similar wood supply problems. Barring a change in national forest policy in the United States, the harvest in the Douglas Fir Region of the Pacific Northwest is forecast to decline over the next two decades while harvest levels in

Finland and Sweden are effectively constrained by the annual increments of their forests.

In contrast to these traditional competitors, however, increased timber harvests from plantation developments in countries like New Zealand and Chile represent a real competitive threat to the British Columbia forest products industry. A report by F.L.C. Reed examines the current state of world forest resources and the prospects for increased softwood harvests in different areas of the world.

Despite the resource constraint confronting British Columbia, adequate supplies of wood fibre exist to support additional pulp capacity in at least two areas of the province, the northeast and the southeast. In the northeast, expansion would depend largely on harvesting the presently unused aspen resource. In the southeast, wood fibre for expansion could be derived from three sources: the present surplus of residual woodchips, utilization of logging residuals presently left in the woods, and whole log chipping of currently unused low quality wood. Fibre availability in the northeast and southeast is analyzed in two reports by the Ministry of Forests. The first, the Southeast British Columbia - Fibre Resource Study was completed in January 1972 and the second, the Peace River - Forest Nelson Fibre Resource Study, was completed in June 1984. The Minister of Forests has invited proposals for pulpwood agreements over these two areas with closing dates of June 6, 1985 for the northeast and July 11, 1985 for the southeast.

While the output of the British Columbia forest products industry will undoubtedly continue to be dominated by the commodity grade products, construction lumber, market kraft pulp and standard grade newsprint, for the foreseeable future, opportunities for increasing product values exist in both the lumber and pulp and paper sectors. To varying degrees, the industry is already pursuing opportunities in the area of higher value added products.

Given the constraints facing the industry, the emphasis on higher value added products must increase if the British Columbia forest products industry is to expand. Efforts to enhance product values are especially important in the coast sector of the industry where increasing wood costs have contributed to the erosion of its competitive position in products like construction lumber and market kraft pulp, where these costs represent a major fraction of manufacturing costs.

A report by Woodbridge, Reed and Associates discusses the current state of secondary manufacturing in solid wood products and the prospects for future expansion. The report concludes that significant opportunities exist to obtain greater value from the British Columbia forest resource, especially hemlock and lodgepole pine, through additional manufacturing either at sawmills or remanufacturers or some combination of both. It estimates that approximately $200 million could be added to the value of approximately 1.4 billion fbm of construction grade lumber through this additional manufacturing. This product upgrading would also have the beneficial side effect of removing a significant volume of dimension lumber from the North American market where prices have been depressed due to an oversupply situation.

A second report by Woodbridge, Reed and Associates evaluates the potential for expanding the production of higher valued paper and paperboard products in British Columbia. The report finds that the potential is the highest for lightweight coated papers and supercalendered offset papers. These products represent a natural extension of newsprint and build on British Columbia's strong international competitive position in electric power.

In summary, the wood supply situation in British Columbia effectively rules out a large scale expansion of the forest products industry based on an increasing harvest but opportunities for growth still exist. To a considerable extent, these opportunities involve a greater emphasis on increasing product value rather than physical output.

The mature forest left to be harvested in British Columbia still represents a valuable resource by world standards and the forest products industry must adapt to ensure that this potential is realized. This will require the adoption of new technologies, attitudes and marketing skills. In this changing environment, mills which fail to adapt will undoubtedly fall by the wayside.

Chapter H2

Trends in Regional Development

This chapter provides an overview of the economic make-up of each region. In addition, it discusses potential developments that could significantly affect the regional economy, its population and its infrastructure or the forest industry. In nearly every region, proposals for resource development have been prepared but, for many of these, it is difficult to predict if or when the development might proceed. Many of the proposals are too undefined to allow the economic or forestry implications to be assessed. Because of the uncertainties, the regional outlook is intended to indicate only the general opportunities over the next twenty years.

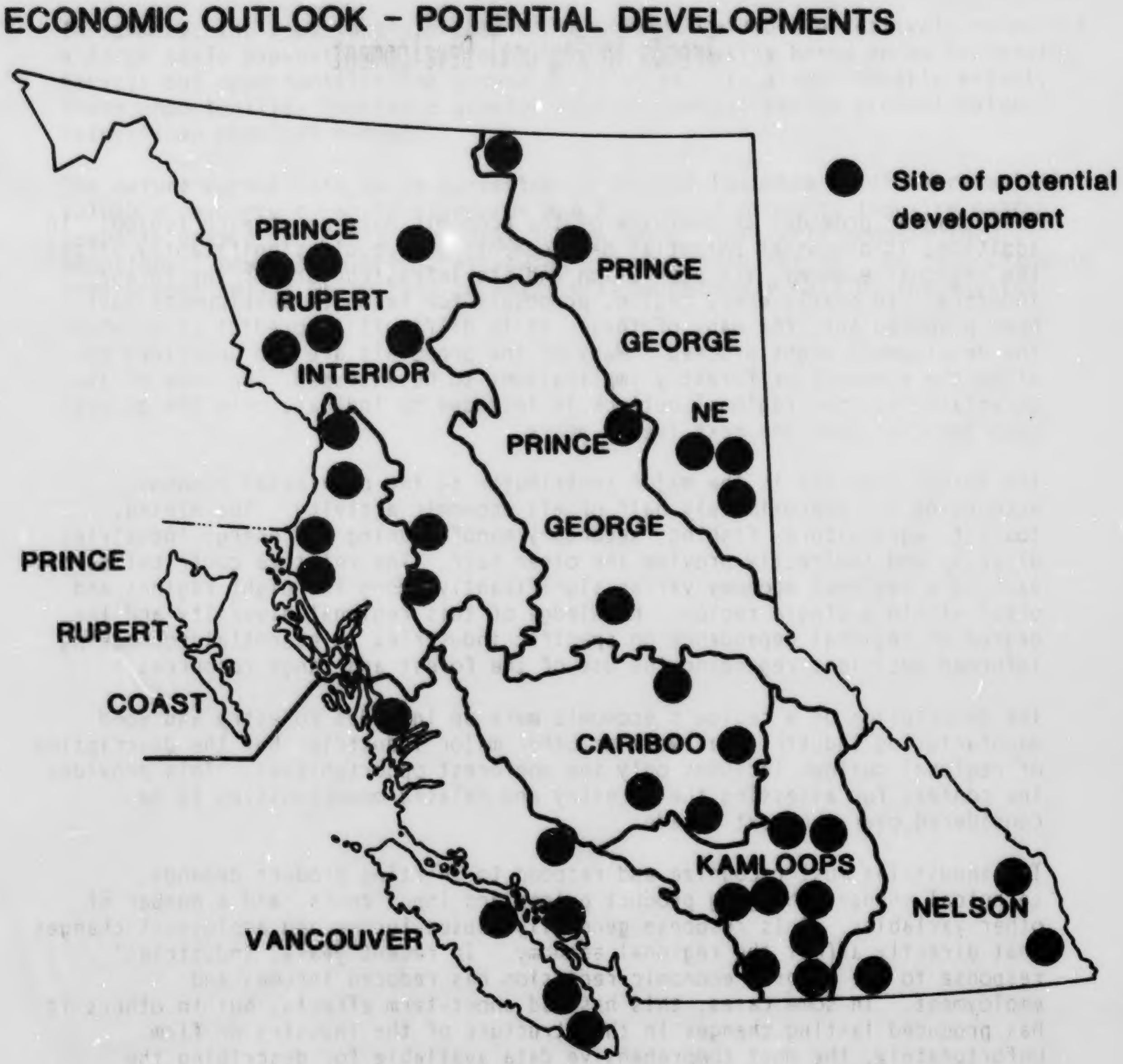
The forest industry is the major contributor to the provincial economy, accounting for approximately half of all economic activity. The mining, tourist, agriculture, fishing, secondary manufacturing and energy industries directly and indirectly provide the other half. The relative contribution of each to a regional economy varies significantly among the eight regions and often within a single region. Knowledge of this regional diversity and the degree of regional dependence on specific industries is essential for making informed decisions regarding the use of the forest and range resources.

The description of a region's economic make-up includes forestry and wood manufacturing industries as well as other major industries but the description of regional outlook includes only the nonforest opportunities. This provides the context for assessing the forestry and related opportunities to be considered over the next decade.

The industries must recognize and respond to shifting product demands, technical change, changing product prices and input costs, and a number of other variables. This response generally causes income and employment changes that directly affect the regional economy. In recent years, industries' response to the general economic recession has reduced incomes and employment. In some cases, this has had short-term effects, but in others it has produced lasting changes in the structure of the industry or firm. Unfortunately, the most comprehensive data available for describing the regional economies are from the 1981 census and, hence, precede the recession's effects. In order to present the most up-to-date picture of the regional economy, the census data have been supplemented with more recent information on plant closures and other major adjustments.

Potential developments referred to for each Resource Analysis Region are indicated on the map in Figure H-1.

Figure H-1. Potential Developments in Resource Analysis Regions


ECONOMIC OUTLOOK - POTENTIAL DEVELOPMENTS
● Site of potential development
PRINCE RUPERT INTERIOR
PRINCE GEORGE
NE
PRINCE GEORGE
PRINCE RUPERT COAST
CARIBOO
KAMLOOPS
NELSON
VANCOUVER

Site No.	Development
1.	Mining activity
2.	Proposed natural gas pipeline
3.	Expanded mining operations
4.	Expanded manufacturing in the existing resource centres
5.	Natural gas liquids fractionation plant
6.	Coquihalla highway
7.	Southeast coal fields
8.	Oil, natural gas and carbon dioxide exploration and well development
9.	Murphy Creek - Keenleyside hydroelectric development
10.	Natural gas liquids straddle plant
11.	Peace Site C hydroelectric development
12.	Liard River hydroelectric development
13.	Alaska Highway natural gas pipeline
14.	Southeast coal field
15.	Aluminum smelter
16.	Cirque mineral property
17.	Kutcho Creek and Mount Klappan Mineral properties
18.	Telkwa coal property
19.	Kemano completion hydroelectric development
20.	Iskut - Stikine hydroelectric development
21.	Prince Rupert port expansion
22.	Western LNG project
23.	Stewart port expansion
24.	Kitsault mineral development
25.	Ocean Falls revitalization
26.	Vancouver Island coal development
27.	Vancouver Island natural gas pipeline
28.	Fertilizer plant
29.	Homathko hydroelectric development

CARIBOO REGION

In 1981, the Cariboo Region's population was 60,751, about 3% of the provincial total. The two largest communities are Quesnel and Williams Lake, each with a population of 8,000. Most of the people, however, reside in the unincorporated area east of the Fraser River (Subdivision A rural). Between 1976 and 1981 the region's growth rate was 2.7%, slightly greater than the provincial average. Most of this growth occurred in Williams Lake and in the rural area east of the Fraser River.

REGIONAL ECONOMY

The bulk of the region's economic activity centers on the forest industry, in 1981 accounting for 26% of the region's experienced workforce. Of the manufacturing industries, the wood and pulp and paper industries shipped about $423 million, 92% of the region's total.

In 1982, 19 permanent sawmills were operating in the region, seven in Williams Lake, six in Quesnel and the remainder in or around 100 Mile House and Clinton. The region's two pulp mills are in Quesnel.

Secondary manufacturing employed about 550 people in 1981, about 2% of the region's labour force. These firms are mainly small ready-mix concrete plants, machine shops, printing shops and bakeries, and most of them are located in either Williams Lake or Quesnel.

Forestry, agriculture, mining and tourism are the region's important primary activities. In general, the region's small communities are dependent on the forest industry and agriculture. Only the region's larger communities of Williams Lake, Quesnel and 100 Mile House have a reasonably developed service sector.

Table H-8 shows the number of persons employed in each industry and what percentage of the total regional labour force those figures represent. For comparison, it also shows what percentage of the total provincial labour force works in each industry.

Agriculture employed about 1,480 persons, 5% of the region's labour force in 1981, and there were 996 agricultural holdings. Cattle ranching is the predominant agricultural activity, accounting for 72 percent of sales over $2,500. Total farm sales in 1980 were $26.6 million.

The region currently has operating mines at Mosquito Creek and Gibraltar. The former is a small-scale gold mine near Quesnel employing 60 people. The latter is a relatively large copper/molybdenum mine north of Williams Lake. Currently, the mine is operating at 50% capacity with a work force of 350, about 300 persons less than during full operations. It will not return to its previous production level unless metal prices increase substantially. The Boss Mountain operation located 100 kilometres east of Williams Lake is temporarily closed due to low molybdenum prices. It will likely remain closed for the next three to five years. At full production, the mine employed between 250 and 270 people.

Table H-8. Experienced Labour Force by Industry (1981)
Cariboo Region

	Persons	Industry Labour Force as a Percent of Total	
		Region*	Province*
Total Experienced	28,645	-	-
Agriculture	1,480	5	2
Forestry	2,140	7	3
Fishing and Trapping	35	0.1	0.4
Mines, Quarries & Wells	930	3	2
Manufacturing	5,965	21	14
Wood Industries	(4,870)	17	4
Pulp & Paper	(570)	2	2
Construction	2,055	7	8
Transportation, Communication & Utilities	1,885	7	9
Trade	4,110	14	17
Finance, Insurance & Real Estate	865	3	5
Business, Community & Personal Services	6,440	22	29
Public Administration & Defense	1,290	5	7
Unspecified/Undefined	1,440	5	4

*columns may not sum due to rounding

Smaller placer gold operations are also active in the region, employing as many as 900 persons.

The major tourist service and accommodation centres are Williams Lake, Quesnel and 100 Mile House. In 1981, the region's tourist revenue was about $70 million, about 3.5% of the provincial total. There were approximately 259 recognized accommodation establishments (hotels, motels, resorts and campgrounds), and the average occupancy rate was 46.5%, well below the provincial average of 57%.

In 1983, the region's unemployment rate was about 16%, well above the provincial average of 13.8%.

ECONOMIC OUTLOOK

Over the next 10 to 20 years we expect the economy to continue to expand at a modest pace.

With respect to agriculture, little unused land is available to develop new ranches; and Crown range, on which the industry is heavily dependent, is fully stocked at present levels. Some grazing land has and will continue to be lost due to community growth and other land uses. In addition, the Homathko power development, new mines, and their related access roads will reduce grazing lands. Such losses increase the competition between ranching and forestry interests. On the other hand, new powerlines (e.g. from the Liard power development) and new pipeline corridors could create more grazing lands.

Mining activity is expected to focus on relatively small-scale gold operations over the next few years. The most advanced project is the Blackdome prospect west of Clinton which could employ around 90 persons.

One of the routes proposed for delivering natural gas to Vancouver Island would cross the Chilcotin; construction of the pipeline would provide short-term employment.

KAMLOOPS REGION

In 1981 the population in the Kamloops Region was 325,599, almost 12% of the provincial total and second only to the Vancouver Region. Between 1976 and 1981 the population grew by 41,199 persons for an annual average growth rate of 2.75%, well above the provincial average.

Because of the large population and diverse economic activity, the region has been divided into two subareas: Kamloops and Okanagan. The Kamloops area covers the region's western section and is composed of parts of the Thompson-Nicola and Squamish Lillooet Regional Districts. The Okanagan subarea includes the three Okanagan Regional Districts and part of the Columbia Shuswap.

REGIONAL ECONOMY

The region's economy is the province's second largest in terms of value of shipments: in 1980, it shipped $1.55 billion worth of goods, 9% of the provincial total. The important primary industries are agriculture, forestry and mining. Although the forest industry is important, it does not dominate the economy in the Kamloops Region to the same extent as in other regions (e.g. the Cariboo, Prince George, Prince George Northeast, Prince Rupert Interior regions). The region also has a well-developed manufacturing base which includes the manufacture of transportation equipment, food and beverages, cement, prefabricated housing, glass bottles, fabricated metal, lumber, pulp and paper.

In spite of the region's economic diversity, the unemployment rate based on 1983 statistics for economic regions 3 and 4 was nearly the highest in the province at 16.3%.

Table H-9 shows the number of persons employed in each industry and what percentage of the total regional labour force those figures represent. For comparison, it also shows what percentage of the total provincial labour force works in each industry.

Agriculture continues to be one of the region's important primary industries. It accounted for 6% of the experienced workforce in the region compared to a provincial average of 2%. In 1981, its products were valued at $170 million.

Table H-9. Experienced Labour Force by Industry (1981) Kamloops Region

	Persons	Industry Labour Force as a Percent of Total Region*	 Province*
Total Experienced	152,420	-	-
Agriculture	8,405	6	2
Forestry	4,005	3	3
Fishing and Trapping	40	0.03	0.4
Mines, Quarries & Wells	4,335	3	2
Manufacturing	19,525	13	14
Wood Industries	(7,705)	5	4
Pulp and Paper	(925)	0.6	2
Construction	14,920	10	8
Transportation, Communication & Utilities	11,095	7	9
Trade	26,935	18	17
Finance, Insurance & Real Estate	6,695	4	5
Business, Community & Personal Services	42,590	28	29
Public Administration & Defence	8,290	5	7
Unspecified or Undefined	5,615	4	4

*columns may not sum due to rounding

In the Kamloops area, the beef cattle industry dominates agricultural activity. This area contains over 50% of the province's open grassland and most of the forested range, and supports more beef cattle than any other forest region. Farm production in 1981 totalled $37.6 million. Agricultural activity in the Okanagan is more diverse. Cattle ranching dominates on the higher elevations; fruits, grapes and vegetables dominate in the valleys south of Vernon; dairy farming, forage and grain crops dominate north of Vernon. In 1981, 57% of the commercial farms were fruit and vegetable, 19% were beef cattle. Farm production in 1981 totalled $131.7 million.

The agricultural industry also sustains secondary manufacturing and service industries of regional significance, including fruit processing and packing, wineries, dairy and poultry processing and transportation.

Forestry and related industries account for about 8% of the region's experienced labour force. In 1982, 32 sawmills were operating in the region. The Kamloops area contained 18 mills and the region's only pulp mill. In the Okanagan area, eight of the permanent mills are located in the Okanagan Valley between Okanagan Falls and Armstrong; three more are at Princeton and three at Lumby.

Mining activity is an important aspect of the regional economy, particularly in the Kamloops area, where six relatively large copper and copper/molybdenum mines are currently operating. The region's largest operations are located in the Highland Valley south of Kamloops.

The Kamloops Region is the second most important manufacturing area in British Columbia, shipping $1.5 billion in production in 1980. The region's more important secondary manufacturing industries are transportation equipment at 31% and nonmetallic minerals at 15% of the total. Food and beverages, chemicals and metal fabrication make up an additional 18%.

Kamloops, Kelowna, Penticton and Vernon are the most important manufacturing centres. In Kamloops, besides wood manufacturing, the cement, chemical, steel fabrication and tire retreading industries are important. In Kelowna, several wineries, a distillery, transport equipment and fruit processors are among the important industries. Vernon has one of the province's largest glass bottling manufacturers as well as metal fabricators and tire retreading plants. Penticton has manufacturers of prefabricated buildings, mobile homes and trailers, fruit processors and a winery.

The tourist industry has become important to the region and has helped diversify the economies in some of the smaller communities, particularly Salmon Arm, Cache Creek, Ashcroft, Merritt, Sicamous, Chase and Osoyoos. In 1982, the industry revenue was approximately $352 million, 17.5% of the provincial total; the number of tourist establishments (hotels, motels, resorts and campgrounds) was about 466. The average hotel occupancy rate in 1982 was 54.3%, slightly below the provincial average of 57%.

ECONOMIC OUTLOOK

The region's economy is relatively diverse and the prospects for growth in both its primary industries and secondary manufacturing industries are good.

Growth in the agricultural industry will be constrained by lack of suitable land and the scarcity of irrigation water. Most of the arable land is already privately held and Crown grazing land is being used fully, particularly in the Okanagan area. However, development potential on Indian Reserves is significant.

Community growth has had a great impact on the agricultural industry by competing for the land base and increasing land prices. In particular, expansion of Kamloops has reduced fruit, vegetable and field crop production. To the extent that grazing land is lost to other uses, the competition between agriculture and forestry for the remaining land base will intensify.

Regarding the mining industry, the region has significant potential. The pace and extent of development will depend primarily on market conditions. No major new mining operations are scheduled to begin in the near future but several existing mines are under re-evaluation and might reopen. Included among these are the Brenda, Hedley and Bralorne mines. The latter, located near Lillooet, could employ 150 people. Operations at the Cominco/Valley Copper property are expected to expand substantially during the next decade. But, no major additions to the area's infrastructure are expected to result. In late 1983, precious metals, copper and zinc were discovered west of Adams Lake. If the property has sufficient reserves, it could be developed in the next 20 years but it is too early to assess potential implications for infrastructure requirements or employment.

A proposal has been made to build a natural gas liquids fractionation plant in Kamloops at the closed Gulf refinery. According to current plans, construction will be completed by late 1985. It will likely produce about 24 person years of construction employment and 23 operating jobs.

The region's outlook for expanded secondary manufacturing is favourable. Its established industrial base plus its central location between Vancouver, Calgary and Edmonton, good transportation infrastructure and pleasant climate should attract new firms to the area. The planned Coquihalla Highway is one of the more significant developments that could stimulate further regional economic growth. As a consequence of the growing regional economy, additional infrastructure will be needed.

NELSON REGION

In 1981 the population in the Nelson Region was 155,272 persons, 5.6% of the provincial total. Between 1976 and 1981, the population grew at an annual average rate of 0.7%. Only the Prince Rupert Coast region had a slower growth rate. The East Kootenay is the region's most populous area and was also the fastest growing with an average annual rate of 3%. Cranbrook, the region's largest community, is located here as well as several communities adjacent to the southeastern coal fields (Fernie, Elkford, and Sparwood).

REGIONAL ECONOMY

The region's economy is relatively diverse with agriculture, the forest industries, mining, manufacturing, and tourism being important sources of income and employment. In 1983, the unemployment rate was about 15.4%; but for East Kootenay Regional District, it was only 13.1%, nearly the lowest rate in British Columbia. In the remainder of the Nelson Region, it was 16.6%, almost the highest in the province.

Table H-10 shows the number of persons employed in the region by industry and what percentage of the total regional labour force those figures represent. For comparison, it also shows what percentage of the total provincial labour force works in each industry.

Agricultural activity occurs throughout the region in the valleys and lower elevations but is concentrated in the south. Although livestock production dominates the sector, substantial diversity is evident. The most intensively farmed area is around Creston where reclaimed flatland at the southern end of Kootenay Lake supports large areas of grains, forages and potatoes. The surrounding benches support fruit trees, dairy and beef cattle. Agricultural sales from the Creston area alone accounted for more than 50% of the region's $27.9 million total sales in 1981. A similar, though smaller, concentration of intensive agricultural activity centers around Grand Forks.

Elsewhere in the region, cattle production is limited by available range. In recent years, Crown range permits have been reduced, particularly in the East Kootenay Regional District, because of weed and forest encroachment, range overuse and wildlife considerations. The region's agricultural potential has also been limited by the substantial loss of arable and potentially arable land resulting from several large hydroelectric power developments on the Columbia River system.

Table H-10. Experienced Labour Force (1981)
Nelson Region

	Persons	Industry Labour Force as a Percent of Total: Region*	Province*
Total Experienced	74,355		
Agriculture	1,575	2	2
Forestry	3,355	5	3
Fishing & Trapping	35	0.05	0.4
Mines, Quarries & Wells	6,830	9	2
Manufacturing	11,815	16	14
Wood Industries	(5,590)	8	4
Pulp & Paper	(905)	1	2
Construction	6,395	9	8
Transportation, Communications & Utilities	6,340	9	9
Trade	10,440	14	17
Finance, Insurance & Real Estate	2,365	3	5
Business, Community & Personal Services	19,285	26	29
Public Administration & Defence	3,845	5	7
Unspecified or Undefined	2,055	3	4

*columns may not sum due to rounding

Logging, wood manufacturing, and pulp and paper production are important to the economy. In 1983, 29 permanent sawmills and 2 pulp mills were operating in the region. Major sawmills are located at Castlegar, Nelson, Canal Flats, Cranbrook, Elko, Donald, Revelstoke, Grand Forks, Midway, Radium and Slocan. One of the pulp mills is located at Skookumchuk and the other at Castlegar.

The relative importance of the forest industries within the Nelson Region varies significantly. They account for 18% of the Central Kootenay labour force and 32% of the Golden area labour force but only 8% of the Kootenay Boundary Regional District, 10% of the East Kootenay Regional District and 11% of the Revelstoke area.

Lead, zinc and silver deposits provide the basis for metal mining and smelting. The Sullivan Mine, located at Kimberley, is the region's largest metal mine, producing lead, zinc, silver and other minerals, and employs about 1,200 persons. It supplies much of the ore processed at the huge smelter-refinery-fertilizer complex at Trail and supports fertilizer production in Kimberley.

The Southeast Coal Field, located in the region's extreme southeastern corner, is the largest coal-producing area in British Columbia. Five mines are operating and employ some 4,300 persons.

The province's largest concentration of industrial mineral operations is found in the Nelson region. Many of the operations are small employing less than 10 people.

The region's primary industries support a relatively diversified secondary manufacturing sector. In 1980, about 450 persons were employed in the region's food and beverage industry; about 400 in fabricating shops and firms producing machinery and transportation equipment; and about 800 in chemical manufacturing firms.

The Nelson region is a very popular tourist area and produced $247 million in revenue in 1982, 12% of the provincial total. The region has 353 recognized accommodation establishments. The occupancy rate was 57%, the provincial average.

ECONOMIC OUTLOOK

The economic outlook for the region is positive with the brightest prospects being in the East Kootenay where the mineral and tourist potentials are substantial.

Of the five mines presently operating in the Southeast Coal Fields, three have expansion plans; in addition, four new coal mines have been proposed. The planned expansion would create 650 additional jobs; the four new mines would create 2,670 additional jobs.

It is unlikely that all of these projects will proceed in the near future. All are to some extent market constrained, and the new mines would require additional infrastructure.

Oil and gas exploration have been active in the Fernie and Flathead basins, and further activity can be expected in the East Kootenay area following an extensive seismic program.

Carbon dioxide was found during oil and gas exploration and a company is now drilling several test wells to assess the commercial feasibility of its production. If the results are favourable, production might begin in 1987-88 and as many as 25 wells could be drilled. A pipeline might also be constructed to transport the carbon dioxide to the oil fields in southwestern Alberta where it would be used in oil recovery operations.

The Sullivan mine reserves are substantial and should sustain production well into the next century but as the mine is being modernized, employment is being reduced.

The tourist industry will likely play an increasingly important role in the regional economy, particularly in the Columbia-Windermere Lakes area.

The forest industry will continue to play a dominant role in the economies of many of the region's communities. The prospects for expanded secondary manufacturing are favourable and will likely occur close to the related primary activity. The prospects for growth in the other industries are not as good. Agriculture production could be increased through more intensive methods, although in most cases it would not be financially attractive to do so.

The Murphy Creek/Keenleyside electric power development, which has a proposed mid-1990's in-service date, would create relatively few permanent jobs.

PRINCE GEORGE NORTHEAST REGION

In 1981, the population in the Prince George Northeast Region was 55,165, about 2% of the provincial total. Nearly half of the people reside in the region's two largest towns, Fort St. John and Dawson Creek. Between 1976 and 1981 the population grew by 10,635, for an average annual growth rate of 4.4%.

REGIONAL ECONOMY

Historically, the region's primary industries have been agriculture, oil and natural gas, construction and forestry but, with the Quintette and Bullmoose coal mines having started operations in 1983, mining must be added to the list.

Because employment figures are available only for the Prince George Northeast Regional District these figures are given in Table H-11. This table shows the number of persons employed in the District and what percentage of the total District labour force those figures represent. For comparison, it also shows what percentage of the total provincial labour force works in each industry.

Agriculture is an important industry from both the regional and provincial perspective. While in 1981, agricultural holdings numbered only 1,871, 9.3% of the provincial total, they accounted for 33% of the total land area in farms. The region is the province's most important grain and forage seed-production area and cattle production has increased rapidly in recent years. Most of the agricultural activity is centred around Dawson Creek and Fort St. John. Farm product sales in 1981 totalled $60 million.

The oil and gas industry (included in the mines, quarries and oil wells category) is a key sector in the regional economy. In 1983, 668 oil-producing wells and 527 gas-producing wells were operating in British Columbia, all in this region. In addition, there are four gas-producing plants in the area: the Fort Nelson plant; the Boundary Lake and Taylor plants located near Fort St. John; and the Pine River plant located near Chetwynd. Industrial activity peaked in 1979 when 395 wells were drilled. Since then, activity has declined and in 1983 only 76 wells were drilled.

The impact of the Northeast Coal Project which provided 8,300 man years of construction employment is not reflected in the 1981 census employment data. Construction began in 1981 but most of the activity took place in 1982 and 1983. The development established an important industry, stimulated the local economy and added significantly to the region's infrastructure.

The two operating coal mine properties, Quintette and Bullmoose, will have a peak operating labour force of about 150 and 450, respectively. Most of the operating labour force is expected to reside in the new community of Tumbler Ridge which is expected to reach a population of 5,000.

Table H-11. Experienced Labour Force by Industry (1981)
Prince George Northeast Region

	Persons	Industry Labour Force as a Percent of Total: Region*	Industry Labour Force as a Percent of Total: Province*
Total Experienced	28,050		
Agriculture	2,280	8	2
Forestry	445	2	3
Fishing & Trapping	45	0.1	0.4
Mines, Quarries & Oil Wells	1,620	6	2
Manufacturing	1,985	7	14
Wood Industries	(1,245)	4	4
Pulp and Paper	-	0	2
Construction	2,880	10	8
Transportation, Communication & Utilities	3,570	13	9
Trade	4,950	18	17
Finance, Insurance & Real Estate	855	3	5
Community, Business & Personal Service	6,580	23	29
Public Administration	1,265	5	7
Unspecified & Undefined	1,570	6	4

*columns may not sum due to rounding

The manufacturing industries accounted for 7% of the regional labour force in 1981 compared to a provincial average of 14%. In 1980, these industries shipped $208 million of products, about 1% of the provincial total. The most important manufacturing activity is sawmilling, accounting for 87% of the region's manufacturing activity. In 1980, sawmills shipped close to $180 million of lumber and paid about $28 million in wages. Two large mills and one small mill are located in Fort Nelson, two in Chetwynd, one in Taylor, and one in Fort St. John. A plywood plant is currently under construction at Fort Nelson.

Little secondary manufacturing is found in the region due to the small local market. Metal fabricating firms are the most important, employing about 130 persons and shipping an estimated $9 million in products. In 1980, manufacturing industries altogether produced products worth about $20 million.

Firms in the transportation industries accounted for 13% of the region's total employment compared to a provincial average of 8%. They include air, railway and truck transport, grain storage, electric power and gas transmission and distribution utilities.

The service industries (Trade, Finance, Community and Personal Service, and Public Administration) that account for nearly half of the region's labour force grew substantially between 1971 and 1981.

In general, the region is not a tourist destination but tourist revenue is obtained from those travelling the Alaska Highway to the Yukon and Alaska. The region has approximately 98 recognized accommodation establishments (hotels, motels, resorts and campgrounds). In 1982 revenue was $50 million, about 2.5% of the provincial total. The average total occupancy rate was 38.9% compared to a provincial average of 57%.

ECONOMIC OUTLOOK

The important primary industries will continue to be agriculture, oil and gas, coal mining and forestry.

This is one of the few areas in British Columbia where new farms can be created on Crown land and land development costs are relatively low. Therefore, more farmland, improved land and greater farm output can be expected. In the future, land-use conflicts between agriculture and forestry could arise since the most attractive agricultural land is often good forest land.

Several proposed gas-intensive developments could significantly boost the oil and gas industry. They are expected to require, in total, 3.5 billion m^3 of natural gas. The significance of this demand can be appreciated when it is compared to the actual 1983 demand, which was 7.02 billion m^3.

Though the industry is in a slump, it is expected to recover to a level where 150 to 200 wells are drilled per year; and if one of the planned gas-intensive projects is realized, as many as 300 wells might be drilled per year.

Other potential industry projects of significance to the region are the proposed gas liquids straddle plant at Taylor and the Alaska Highway Natural Gas Pipeline. Construction of the straddle plant is scheduled to begin in late 1984 with an in-service date of 1985. The project would create 125 man years of construction employment and ten permanent jobs. The Alaska Highway Natural Gas Pipeline would have a significant impact on the region during construction but it has been indefinitely delayed.

The Prince George Northeast Region is rich in coal resources which should bring sustained economic growth to the area. Besides the two operating mines of the Northeast Coal Project, there are at least 11 other potential coal projects. All of them are market constrained and several require infrastructure, which could slow development.

The impact of coal or oil and gas developments on the forest resource is mixed. A development can preclude timber production on some lands but it can also provide access to forests that would otherwise have been uneconomic to harvest.

The region contains three large potential hydroelectric developments: the Site C and Site E on the Peace River and the Liard project. Currently, only

Site C is scheduled for development but it will likely not be required until the late 1990's. That project would reduce the allowable annual cut by some 4,700 m^3.

The Liard project is considered one of the principal alternatives to Site C. B.C. Hydro estimates that the project could reduce the allowable annual cut by 60,000 to 80,000 m^3 (for the reservoir only).

PRINCE GEORGE REGION

The population in the Prince George Region in 1981 was 105,283, about 4% of the provincial total. Between 1976 and 1981 the region's growth rate was 2.3%, significantly less than the 1971 to 1976 period when it averaged 4.4%. Prince George is the region's most populous community accounting for nearly 65% of the total.

REGIONAL ECONOMY

The forest industries have been responsible for growth in the region over the past twenty years. Besides forestry and wood manufacturing, agriculture and tourism are significant industries. Table H-12 shows the number of persons employed by industry and what the percentage of the regional labour force those figures represent. For comparison it also shows what percentage of the total provincial labour force works in each industry.

Table H-12. Experienced Labour Force by Industry (1981)
Prince George Region

	Persons	Industry Labour Force as a Percent of Total	
		Region*	Province*
Total Experienced	53,215		
Agriculture	1,080	2	2
Forestry	2,915	5	3
Fishing and Trapping	30	0.05	0.4
Mines, Quarries & Wells	750	1	2
Manufacturing	10,685	20	14
Wood Industries	(6,555)	12	4
Pulp & Paper	(2,675)	5	2
Construction	4,080	8	2
Transportation, Communication & Utilities	5,165	10	7
Trade	8,860	17	17
Finance, Insurance & Real Estate	1,980	4	5
Business, Community & Personal Services	12,650	24	29
Public Administration & Defense	3,060	6	7
Unspecified/Undefined	1,975	4	4

*columns may not sum due to rounding

Forestry and related industries are the backbone of the region's economy and account for 91% of its labour force. In 1983, 33 sawmills and 5 pulp mills were operating. Three of the pulp mills are located in Prince George and two in Mackenzie.

For several of the region's smaller communities - for example, McBride, Valemount, Fort St. James, and to a slightly lesser degree Fraser Lake and Vanderhoof - logging, sawmilling and other wood processing are the economic mainstay.

In 1981, agriculture employed 1,080 persons, 2% of the regional labour force. There were 1,081 farm holdings, mostly concentrated on the ranches adjacent to the Fraser River south of Prince George, around McBride and along the Nechako River near Vanderhoof. Livestock and forage production are the dominant activities. Sales in 1981 totalled $19.7 million. Between 1971 and 1981, improved farmland almost doubled and cattle numbers increased substantially. Summer range is abundant and logging increases the amount available each year, but limited spring grazing and winter feed supplies constrain increased livestock production.

The mining industry is a relatively small contributor to the regional economy. In 1981, the mines, quarries and wells industrial classification accounted for 750 of the experienced labour force, about 1% of the region's total.

The region's secondary manufacturing base is located almost entirely in Prince George. In 1981, the experienced labour force was about 2,100 persons, 3.9% of the region's labour force. The firms located in Prince George include manufacturers of sawmill equipment, logging equipment, prefabricated homes, chemicals, concrete products, steel fabricators, food and beverage firms and the Husky Oil refinery.

The tourist industry is also focussed on Prince George and the surrounding areas. The region's estimated tourism revenue in 1982 was $45 million, about 2% of the provincial total. There were 58 recognized establishments (hotels, motels, resorts and campgrounds). The average occupancy rate was 50%, slightly below the provincial average of 57%.

In 1983, the unemployment rate in economic regions 7 and 8, which together are larger than the Prince George Region, was about 15.5%, well above the provincial average.

ECONOMIC OUTLOOK

Growth can be expected in the region's manufacturing, tourist, service and forest industries. Although we expect the regional economy to become relatively more diverse, it will continue to be primarily forest based. Prince George, being the transportation hub and manufacturing centre for northern British Columbia, will continue to grow in response to economic growth in adjacent areas.

The most significant industrial development is the aluminum smelter proposed for the Vanderhoof area. The smelter would cost about $1 billion, require

3,650 man years of construction labour and provide permanent employment for some 760 persons. The company applied to the provincial government for an energy project certificate but the in-service date for the smelter is uncertain. The company recently announced that its development plans are in abeyance. The smelter and the related hydroelectric works would have some impacts on forestry and agriculture.

The region's mining industry will continue to play a relatively minor role. The only major potential metal mine identified at this time is the Cirque property, northeast of Williston Lake, but development must await improved metal markets. If developed, the operation is expected to be a relatively large-scale, underground mine. Road access to the property may have some forestry implications.

PRINCE RUPERT INTERIOR REGION

The Prince Rupert Interior Region's population in 1981 was 31,849, the lowest of the eight regions at only 1% of the provincial total. Its annual growth rate, however, was second highest at 4% between 1976 and 1981.

Over 90% of the region's population is found along the Highway 16 corridor which links Prince George and Prince Rupert. This includes the region's largest communities of Smithers, Houston, Burns Lake and Hazelton.

REGIONAL ECONOMY

Economic activity, like the population, is concentrated in the southern part of the region along Highway 16. Forestry, mining, tourism and agriculture are the relatively important activities; forestry and mining dominate in the northern section. Due to the small population and distance from markets, secondary manufacturing is almost nonexistent.

Table H-13 shows the number of persons employed in the region by industry and what percentage of the total regional labour force those figures represent. For comparison, it also shows what percentage of the total provincial labour force works in each industry.

The forest industries dominate the regional economy. Together, forestry and the wood industries account for almost 24% of the region's experienced labour force.

In 1982, 13 permanent sawmills were operating in the region. The largest is at Houston; others are located at Smithers, Burns Lake, Hazelton and Kitwanga. A particleboard plant is located at Smithers.

Most of the region's agricultural activity is concentrated in the Bulkley Valley between Houston and Smithers where dairy farms, grain, forage and vegetable crops are found. Cattle ranching is the predominant agricultural activity south of Burns Lake and in the Kispiox Valley near Hazelton. In 1980, there were 474 farm holdings with total sales of $8.8 million. Of these, 308 farms had annual revenues greater than $2,500.

Table H-13. Experienced Labour Force (1981)
Prince Rupert Interior Region

	Persons	Industry Labour Force as a Percent of Total	
		Region*	Province*
Total Experienced	14,755		
Agriculture	385	3	2
Forestry	1,275	9	3
Fishing and Trapping	40	0.3	0.4
Mines, Quarries & Wells	1,690	11	2
Manufacturing	2,560	17	14
Wood industries	(2,135)	14	4
Pulp and paper	(65)	0	2
Construction	715	5	8
Transportation, Communications & Utilities	1,185	8	9
Trade	1,755	12	17
Finance, Insurance & Real Estate	385	3	5
Business, Community & Personal Services	3,260	22	29
Public Administration & Defence	800	5	7
Unspecified or Undefined	695	5	4

*columns may not sum due to rounding

Mining accounts for most of the economic activity away from the Highway 16 corridor and in 1981 employed 11% of the region's total labour force. But since then, a number of the region's major operations have closed, including the Granisle, Bell Copper and Granduc copper mines. In total, these mines, when operating at full capacity, employed about 1,200 persons. The Granduc mine is closed permanently and the Granisle mine indefinitely but the Bell operation is expected to reopen in the near future. Four major mines are currently operating: the Equity Silver mine, Brinco's open pit asbestos mine, the Erickson gold mine and the Scottie gold mine. All of these have existing reserves suggesting a mine life of five to ten years.

ECONOMIC OUTLOOK

In the long term, significant economic expansion could result from mineral development but this will require new or upgraded infrastructure. For a comprehensive treatment of the region's development opportunities, see the Northwest Economic Development Studies (Ministry of Industry and Small Business Development, 1983).

Mineral exploration in the area north of the Highway 16 corridor to the Yukon border is the most active in the province. A silver-copper-zinc deposit is located due east of Dease Lake on the Kutcho Creek property; its development would require a new 110 kilometre road from Dease Lake. Mt. Klappan is potentially a large-scale anthracite coal mine, located 90 km north of the end-of-steel on the Dease Lake extension and adjacent to the west side of

Spatsizi Park; its development would require a new road, rail links and electrical power and, if it were developed to its largest capacity, a new townsite capable of housing 3,500 people might be required. Development of these properties could have a positive impact on forestry activities since they would provide access to previously remote areas.

Mineral exploration is also active in the Stewart area and southeast of Smithers. The most well defined is the Big Missouri/Premier property located near Stewart. This lead-zinc and precious metal property could be developed in the early 1990's and employ 200 persons. The area south of Smithers is well mineralized but no developments are planned at this time.

The Telkwa coal deposit, south of Smithers, is an attractive thermal coal property because of the coal's characteristics and its location near the coal terminal at Prince Rupert. The development would require an access road and electric power and an operating work force of about 300 persons. Development of this property would likely affect forest and rangeland capabilities. These impacts are to be addressed in the companies' Stage II reports.

A number of other properties might be developed some time in the future but not for the next ten years. Because most of these properties are relatively difficult to reach and are in areas of relatively low timber value, their development is not expected to have substantial forestry implications.

The development of the mineral potential will draw people to the region and thus will produce growth in the service sector and secondary manufacturing industries. Even with these new developments, however, the communities along the Highway 16 corridor will continue to depend heavily on the forest sector as a primary source of economic activity and employment.

Alcan's proposed Kemano Completion Project would create some activity during construction of a dam and diversion tunnel at Nanika Lake but the employment impact would be short term. The Iskut Canyon, Stikine Canyon and More Creek hydroelectric sites, slated for development in the late 1990's, would require some 13,161 man-years for construction. The reservoir created by these projects would reduce the annual allowable cut of the region by about 2% and the transmission corridor would alienate additional forest land.

PRINCE RUPERT COAST REGION

In 1981, the population in the Prince Rupert Coast Region was 62,329, 2.2% of the provincial total. Almost two-thirds of the people reside in Prince Rupert, Kitimat and Terrace. Between 1976 and 1981 the regional population increased by only 2,629 persons, an average growth rate of 0.9%, the lowest rate of the eight regions.

REGIONAL ECONOMY

Forestry, fishing and manufacturing are the region's important primary industries. In 1981, the experienced labour force in the region numbered 32,675, 2.3% of the provincial labour force. Of this, 74% resided in the region's two major communities: Prince Rupert and Kitimat.

The region's economy is fairly diverse overall but individual communities tend to be dominated by a single industry. The Kitimat economy is dominated by the huge Alcan aluminum smelter with the Eurocan pulp and paper complex playing a secondary role. The Prince Rupert economy shows the greatest diversity. Fishing and fish processing have traditionally dominated the economy but the two integrated pulp mills, a growing tourist trade and port activities, including the new Ridley Island port facility, have broadened the community's economic base.

Table H-14 shows the number of persons employed in the region by industry and what percentage of the total regional labour force those figures represent. For comparison, it also shows what percentage of the total provincial labour force works in each industry.

The region's mountainous topography limits agricultural activities. Farm production is largely of a subsistence nature or oriented to the local market. In 1981, of the 108 farm holdings, only 45 had sales over $2,500. Total sales in 1981 amounted to $1.4 million.

Fishing and fish processing are relatively important to the regional economy. In 1982, 1,755 fishermen and about 1,780 fish-processing employees worked in the region. The estimated wholesale value of fish products processed averaged $150 million annually between 1980 and 1982. In 1983, nine fish processing plants were operating: five in Prince Rupert and one each in Namu, Masset, Bella Bella and Port Simpson. The industry consolidated recently, thereby reducing employment by about 300 people to the level reported above; and further reductions are possible given the relatively low salmon harvest anticipated in the next two years.

In addition to the fishing and fish processing activities, three major salmonid enhancement facilities operate in the region, two on the Queen Charlotte Islands and one at Kitimat.

Mining activity is limited, with two of the region's largest operations currently closed: the molybdenum mine at Kitsault (Alice Arm) and the iron mine at Tasu on the Queen Charlotte Islands. The former has sufficient reserves for about 20 years but it will remain closed until molybdenum markets improve. The latter closed permanently in 1983 because it had exhausted its reserves.

Even though the region has significant timber resources, forestry and wood manufacturing play a minor role in the regional economy compared to other forest regions, employing only 15% of the regional labour force in 1981. Pulp mills located in Prince Rupert and Kitimat comprise the paper products group. The pulp and paper mill located at Ocean Falls closed permanently in 1980.

Secondary manufacturing, excluding fish processing, employs about 650 persons. Several shipyards located in Prince Rupert are of some significance. The methanol plant at Kitimat, which began operations in 1982, adds diversity to the economy and employs about 80 persons. Other secondary manufacturing activities include steel fabricating, concrete manufacture, printing shops, machine shops and bakeries. Not reflected in the 1981

Table H-14. Experienced Labour Force (1981)
Prince Rupert Coast Region

	Persons	Industry Labour Force as a Percent of Total Region*	 Province*
Total Experienced	32,675	-	2
Agriculture	115	0.4	2
Forestry	2,300	7	3
Fishing & Trapping	1,755	5	0.4
Mines, Quarries & Wells	600	2	2
Manufacturing	8,005	24	14
Wood Industries	(755)	2	4
Pulp and Paper	(1,865)	6	2
Construction	1,975	6	2
Transportation, Communications & Utilities	2,540	8	9
Trade	3,735	11	17
Finance, Insurance & Real Estate	890	3	5
Business, Community, & Personal Services	6,895	21	29
Public Administration & Defence	2,600	8	7
Unspecified or Undefined	1,115	3	4

*columns may not sum due to rounding

statistics is the impact of the recent port expansion at Prince Rupert which probably had a positive impact on steel fabricating and concrete manufacturing firms.

The tourist industry brought about $67.5 million in revenue to the region in 1982. The region has 86 recognized accommodation establishments and, in 1982, the average hotel occupancy rate was 46%, well below the provincial average of 57%.

The city of Prince Rupert is the focus of most tourist activity but the Queen Charlotte Islands have excellent tourist development potential. However, the Island's limited transportation network and the community attitude in general to tourist development are real impediments to the industry's future growth.

ECONOMIC OUTLOOK

The region will continue to depend on the fishing, forestry and aluminum smelting industries.

The ports of Prince Rupert and Kitimat will likely grow as shipments from the Northeast Coal Field arrive and as shipments of grain and various manufactured items from the prairie provinces increase. Offshore oil and gas exploration may also contribute to the regional economy. Other potential developments that could affect the region include a proposed liquified natural gas plant, expanded port facilities at Stewart to handle forest products and additional mineral shipments from new mines opening up in the northwest interior.

The liquified natural gas plant would be located at Grassy Point, near Prince Rupert. It would create 3,400 man years of construction employment in the Prince Rupert area and would have an operating labour force of 92.

Ancilliary works include a new pipeline from McLeod Lake to Grassy Point. The project would have a relatively minor impact on the forest resource arising primarily from the pipeline corridor.

We expect new mines to contribute to the future regional economy. The Kitsault-Alice Arm area is heavily mineralized and, with improved metal prices, some small-scale development will likely occur. Prospects for the Queen Charlottes are also good. In particular, if the environmental requirements are met, the Cinola Gold Project could begin production in the next three to five years and would employ some 350 persons.

Plans to expand the region's electric transmission system are in place. A new 500 KV line between Terrace and Prince Rupert is planned for the latter 1980's to meet anticipated demands. If the Kemano Completion Project proceeds, two new 287 KV lines would be required between Kitimat and Terrace.

VANCOUVER REGION

The Vancouver Region is the most populous area in the province. In 1981, 1,948,219 persons resided there, 71% of the provincial total. This accounts for its being the economic, financial, cultural and political center of British Columbia. The annual growth rate between 1976 and 1981 was 2.1%

Because of the region's large population and diverse economic activity, it has been divided into four subareas: the Lower Mainland, the Sunshine Coast, Vancouver Island and the mid Coast. The Lower Mainland is composed of the Greater Vancouver Regional District and the three Fraser Valley Regional Districts. The Sunshine Coast is composed of the Powell River and Sunshine Coast Regional Districts and part of the Squamish Lillooet Regional District. Vancouver Island includes Vancouver Island plus the mainland portions of the Mount Waddington and Comox-Strathcona Regional Districts. The mid Coast includes the south coastal portion of the Prince Rupert Forest Region, which is currently being transferred to the Vancouver Forest Region. Detailed data for the mid Coast are lacking and it will be given only passing mention in the text.

REGIONAL ECONOMY

Economic activity within the Vancouver Region makes up a large proportion of the provincial total. In 1980, the region shipped about $11.3 billion of manufactured products (66% of the provincial total), paid about $2.3 billion in wages and accounted for 72% of the province's experienced labour force. In 1983, the Lower Mainland and the Sunshine Coast had the lowest unemployment rates in the province, at 12.6%.

Some indication of the relative importance of an industry can be obtained from the size of its experienced labour force. Table H-15 shows the number of people in each industry in the region as a whole and the percentage in each subarea.

Most of the agricultural labour force is found in the lower mainland, with the remainder on Vancouver Island. Owing to the mild climate, rich soils and proximity to markets, agricultural production is diverse and the value substantial. Although the region has only 7% of the provincial farm land, it accounts for more than 60% of the province's farm cash receipts.

In relative terms, forest industry employees make up a large proportion of the experienced labour force on Vancouver Island and the Sunshine Coast. In 1981, Vancouver Island had only 24% of the regional labour force but accounted for 62% of the region's experienced forestry labour force. The Sunshine Coast had only 2.3% of the total regional labour force but accounted for nearly 10% of the forestry labour force.

The Sunshine Coast also depends heavily on forestry and related industries. Besides logging activity, it contains three pulp mills (located at Powell River, Woodfibre and Port Mellon) and four relatively small sawmills. The Powell River pulp mill is one of the largest in British Columbia.

The forest industry is also important in the Lower Mainland in an absolute sense, but it is not as important relative to the area's total activity as it is in the other subareas, comprising only 15% of the total experienced labour force. In 1982, 37 sawmills and 2 relatively small paper mills were operating in the area.

The provincial fishing and fish processing industries are centered in the Vancouver Region. About 80% of the province's 8,500 fishermen reside here and in 1981 the experienced labour force in fish processing numbered 3,645. However, employment has declined since then with the closing of a fish processing plant in Victoria (200 persons) and the rationalization of facilities in the Greater Vancouver area. The wholesale value of the fish products processed in the region averaged $326 million annually over the 1980-82 period which amounted to two-thirds of total provincial production.

The region also has 11 Salmonid Enhancement facilities, four in the lower mainland, six on Vancouver Island and one at Bella Coola.

In 1981, the mines, quarries and wells industries in the region employed 5,820 persons. The region's two largest metal mines are located on Vancouver Island. Island Copper is located on Rupert Inlet near Port Hardy and employs about 850 persons. The Myra/Lynx operation is located on Buttle Lake west of Campbell River and employs about 400 people.

Table H-15. Experienced Labour Force in 1981 by Industry (1981)
Vancouver Region

		Industry Labour Force as a Percent of Regional Total		
	Vancouver Region (people)	Lower Mainland Sub-area*	Sunshine Coast Sub-area*	Vancouver Island Region Sub-area*
Total Experienced	1,018,904	75	2	24
Agriculture	16,250	79	2	19
Forestry	20,595	29	9	62
Fishing & Trapping	6,750**	67	4	29
Mines, Quarries & Wells	5,820	63	7	30
Manufacturing	137,370	76	3	21
Wood Industries	(30,910)	67	2	31
Pulp and Paper	(15,775)	32	2	46
Construction	72,210	70	3	27
Transportation, Communications & Utilities	90,925	81	3	17
Trade	175,795	77	1	21
Finance, Insurance & Real Estate	61,610	81	1	18
Community, Business & Personal Services	310,705	72	2	23
Public Administration & Defence	74,850	58	1	40
Unspecified	38,130	75	2	22

*columns may not sum due to rounding

**estimate based on the number of fishing vessels and the average crew size rather than census data.

The pulp and paper mill capacity in the Lower Mainland subarea does not require the labour force indicated by the data. Some of these might be employees of the Woodfibre or Port Mellon mills in the Sunshine Coast subarea or unemployed mill workers.

The Carolin gold mine located near Hope is the only other large operating mine in the region and employs about 135 people. The expected remaining life is between two and seven years.

Except for Wolf Mountain, which began operating in 1984 under a limited production period, no coal mines are currently operating in the Vancouver region. Nor are there any operating oil or gas wells, although parts of the region could have significant hydrocarbon potential. Some drilling activity (for gas or oil) is likely within five years, probably in the Nanaimo and Courtenay areas.

The developed infrastructure, large population, higher education and training institutions make the region suitable for secondary manufacturing, particularly the Lower Mainland which accounts for more than 70% of the province's total secondary manufacturing activity. Secondary manufacturing is also important on Vancouver Island, particularly in Victoria and Nanaimo. In Victoria, shipyards, food processing firms, foundries, machinery and machine shops and metal fabricators are important industries. In Nanaimo, industrial chemicals, machine shops and food processing firms are important.

The tourist industry is included in the Community, Business and Personal Services Category. In the Vancouver Region it produced revenues of about $1,140 million in 1982, 57% of the provincial total. About 61% of the revenue was in the Lower Mainland and Sunshine Coast areas; and the remaining 39% was on Vancouver Island. The region contains 732 establishments (hotels, motels, resorts and campgrounds) and in 1982 had an average occupancy rate of 57%, the provincial average.

The service sector industries and public administration comprise 62% of the region's total labour force, with most of this being concentrated in the urban areas. In the Lower Mainland and Capital Regional District over 70% of the total experienced labour force are in service industries and public administration.

ECONOMIC OUTLOOK

Though the region supports a wide range of industries, it is highly dependent on the forest resource and any changes in forest activity could have profound effects on the region's economy. Summarized below are potential projects that could have important economic significance.

Considerable mineral exploration is being undertaken throughout the entire region. This activity is generally focussed on precious metals and small polymetallic deposits. In 1983, 18 major properties were being explored. Eleven of these were on Vancouver Island, four were near Hope, one near Squamish and two on the Sunshine Coast. The Ashlu Gold Project, northwest of Squamish and the Harrison Lake Gold Project are expected to begin operations in 1984, employing 50 and up to 30 people, respectively.

Over the next few years, several coal operations could begin operations on Vancouver Island. The Quinsam Project, west of Campbell River, is the largest. The project would require 200 man-years during the construction phase and an operating labour force of 250.

The Wolf Mountain and Countryside Coal properties near Nanaimo are more modest projects with an expected operating labour force of less than 50 each. Wolf Mountain is an underground thermal coal project which received a limited production permit in late 1983. The permit allows for production over a three-year period for consumer testing. The Countryside Coal project will rework the waste piles of previous mines and might produce up to 100,000 tonnes per annum.

The Homathko Project is the only potential hydroelectric development under consideration in the region. It is considered a principal alternative to the Peace Site C project and would not be developed until the late 1990's at the earliest.

CHAPTER H3

TRENDS IN ECONOMICALLY RECOVERABLE TIMBER STOCK

For an area of forest land, the stock of harvestable mature timber can be displayed as the proportion available at sequential steps of harvesting costs. Economic stock supply distributions allow estimating the amount of mature timber available in varying market conditions and under differing future harvesting costs. The nature of the supply in different areas of the province can also be compared.

For the purposes of this Resource Analysis, four timber supply areas (TSAs) in two forest regions were examined. These TSAs were chosen because they represent typical coast and southern interior harvesting areas. In addition, the necessary data were available, particularly information about species distribution among the various slope classes. Cost distributions were constructed for the Merritt and Lillooet TSAs in the Kamloops Region, and the Kingcome and Nootka TSAs in the Vancouver Region. These distributions are based on the mature timber volumes on productive forest lands only. This timber stock represents the gross supply of merchantable timber as defined in Section B of this report and makes no allowances for the deductions that are made when estimating the amount of timber actually available for harvesting. Net mature volume is gross supply minus allowances for problem forest types, environmentally sensitive areas, unsalvaged losses, land alienations and areas of deferred harvesting. Therefore, the timber stock in the different logging cost ranges shown here does not represent the amount of timber available for harvest. The nature of the data did not allow identifying the net land base in the cost study but the implications of the approach used are discussed at the end of this chapter.

The methods used to estimate logging costs for the timber stock are described in detail in a background report. Briefly, information on stand volume and piece size was derived from forest inventory data, cruise reports and other sources for four species aggregations:

- Fir, Western White Pine and Ponderosa Pine growth types
- Hemlock and Cedar growth types
- Balsam and Spruce growth types
- Lodgepole Pine growth types.

All information was referenced to forest compartments, which are the smallest inventory subunits within timber supply areas. Logging cost information from recent cutting permit appraisals was linked to the stand information and to the slope distribution for each of the four species aggregations. The latter was derived from a report by Hedin (1978), Timber and Slope Characteristics

Influencing Future Harvesting in British Columbia, FERIC Technical Report No. TR-21. Road building and transportation costs were estimated for each compartment by experienced staff in the regional offices.

Through these procedures, all of the variables considered in appraising logging costs within an individual stand of timber were approximated for each stratum of mature timber within the whole TSA.

The results are described first for the interior TSAs and then for the coastal units.

LILLOOET TSA

The total area, excluding TFLs, of the Lillooet TSA is 1,125,600 hectares. Of that, 405,300 hectares or 36% are judged to be available for timber harvesting. The AAC is set at 800,000 m³, a harvest rate that is expected to be sustainable for a period of approximately 20 years as determined by the TSA Yield Analysis Report. That period is based on a number of assumptions, including improved access development and accelerated harvesting to salvage the heavy mortality losses occurring in lodgepole pine stands. The rate also implies that industry must take an increasing proportion of the harvest from lower volume stands. Several other assumptions also apply.

The logging costs for the timber stock in the Lillooet TSA are shown in Figure H-2.

MERRITT TSA

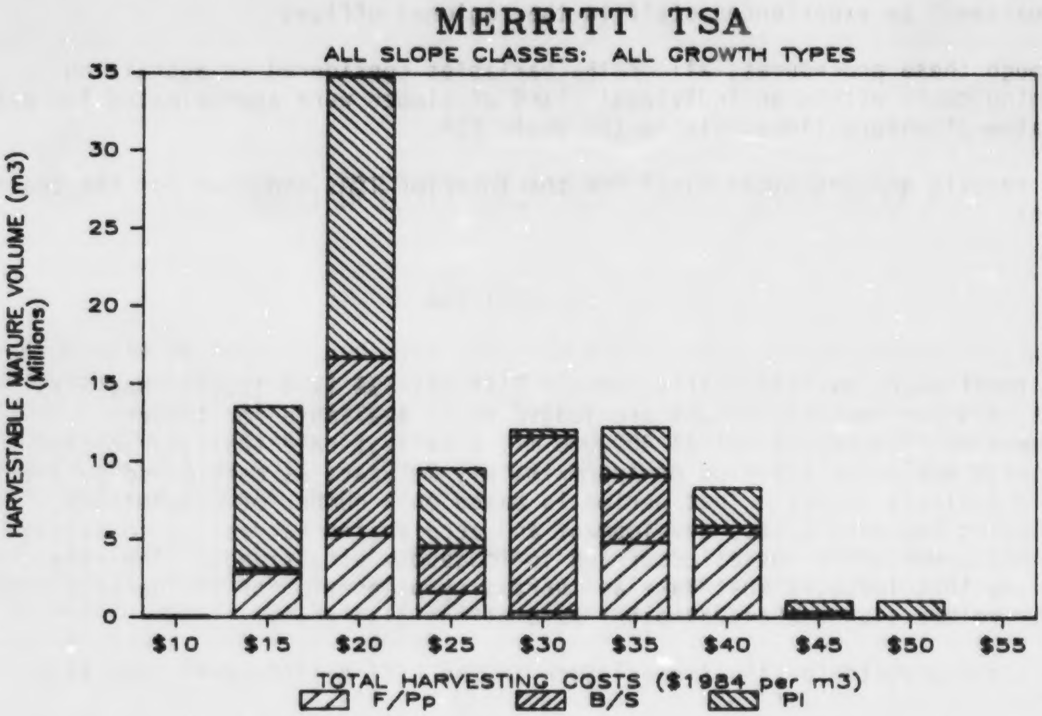
The total area, excluding TFLs, of the Merritt TSA is 1,117,000 hectares. Of that, 614,000 hectares or 55% are judged to be available for timber harvesting. The AAC is set at 1,150,000 m³, a harvest rate that is expected to be sustainable for a period of about 100 years as determined by the TSA Yield Analysis Report. That period is based on a number of assumptions including taking a larger proportion of the harvest in lodgepole pine stands; older lodgepole pine stands must be given harvesting priority; and road access must be developed to increase the recovery of timber infected with Mountain Pine Beetle. Several other assumptions also apply.

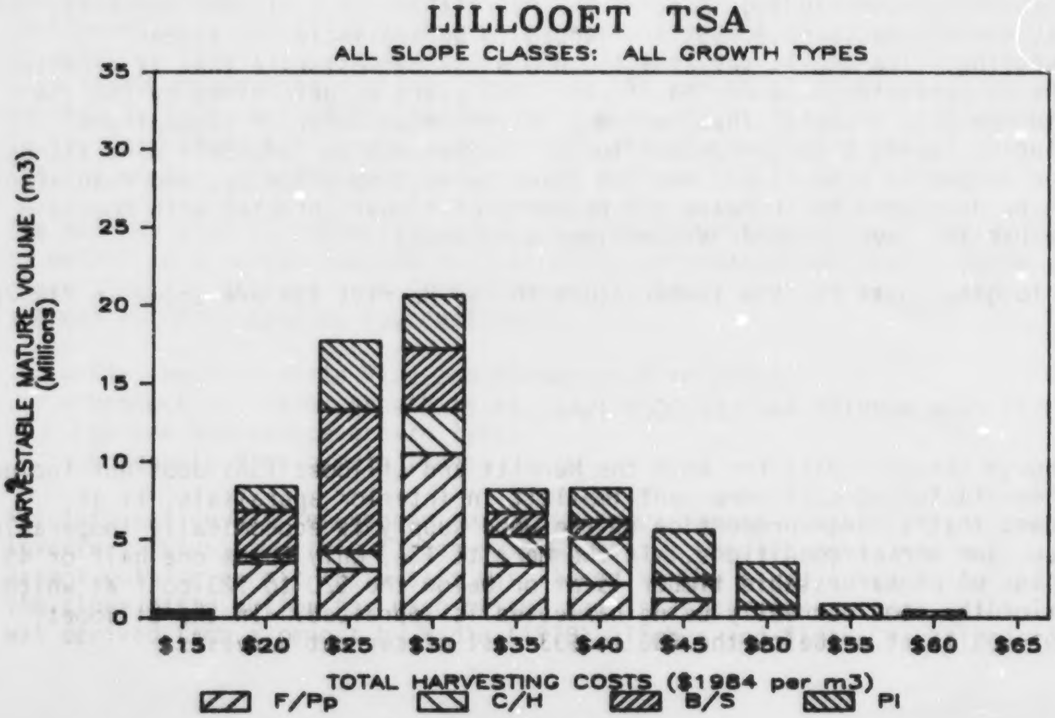
The logging costs for the timber stock in the Merritt TSA are shown in Figure H-3.

RESULTS FROM MERRITT AND LILLOOET TSAs

Although the cost data for both the Merritt and Lillooet TSAs does not include the manufacturing cost component implicit in interior appraisals, it is evident that a large proportion of the wood supply is economically inoperable under 1984 market conditions. In the Merritt TSA, only about one-half or 45 million m³ of harvestable timber is at or below the $20 to $23 cost at which most of the wood currently being harvested is appraised. In the Lillooet, about 60% is at or below the $30 to $33 cost of current harvests.

Figures H-2 & 3. Logging Costs for Mature Timber: Merritt and Lillooett TSAs





Costs are likely to increase as marginal wood on steeper slopes becomes available only by high lead yarding methods. In the Merritt TSA, for example, virtually all harvesting is presently done by ground skidding. Up to 50% higher costs with a significant start-up investment can be expected as logging moves to the high lead system.

The main factors affecting logging costs appear to be volume per hectare, skidded piece size and distance-related harvesting costs. Slope appears to have little effect on total logging costs but does raise individual component costs such as falling and bucking.

KINGCOME TSA

The total area, excluding TFLs, is 1,233,400 hectares. Of that, 354,300 hectares or 29% are forested with coniferous species and are available for timber harvesting. The AAC is set at 1,700,000 m³.

The forest of the Kingcome TSA is composed chiefly of mature and overmature stands with only a minor component of immature age classes. The AAC was selected as the most suitable level to achieve an improvement in age class structure and to increase the productivity of areas now occupied by old growth stands. It is projected that the current old growth component of the TSA will sustain the rate of harvest for a period in excess of 50 years as determined by the TSA Yield Analysis Report.

The logging costs for the timber stock in the Kingcome TSA are illustrated in Figure H-4.

NOOTKA TSA

The total area, excluding TFLs, of the Nootka TSA is 371,000 hectares. Of that, 204,000 hectares or 55% are forested with coniferous species and are available for timber harvesting. The AAC is set at 1,400,000 m³.

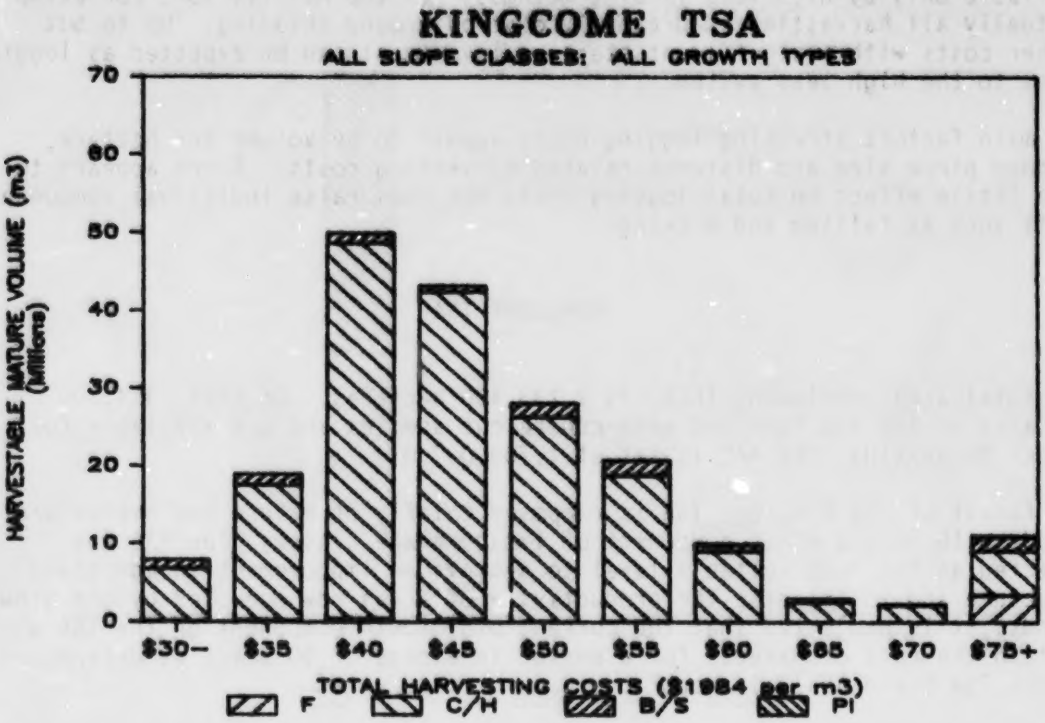
The forest of the Nootka TSA is composed chiefly of mature and overmature stands with only a minor component of immature age classes. The AAC was selected as the most suitable level to achieve an improvement in age class structure and to increase the productivity of areas now occupied by old growth stands. It is projected that the rate of harvest can be sustained for a period in excess of 50 years as determined by the TSA Yield Analysis Report.

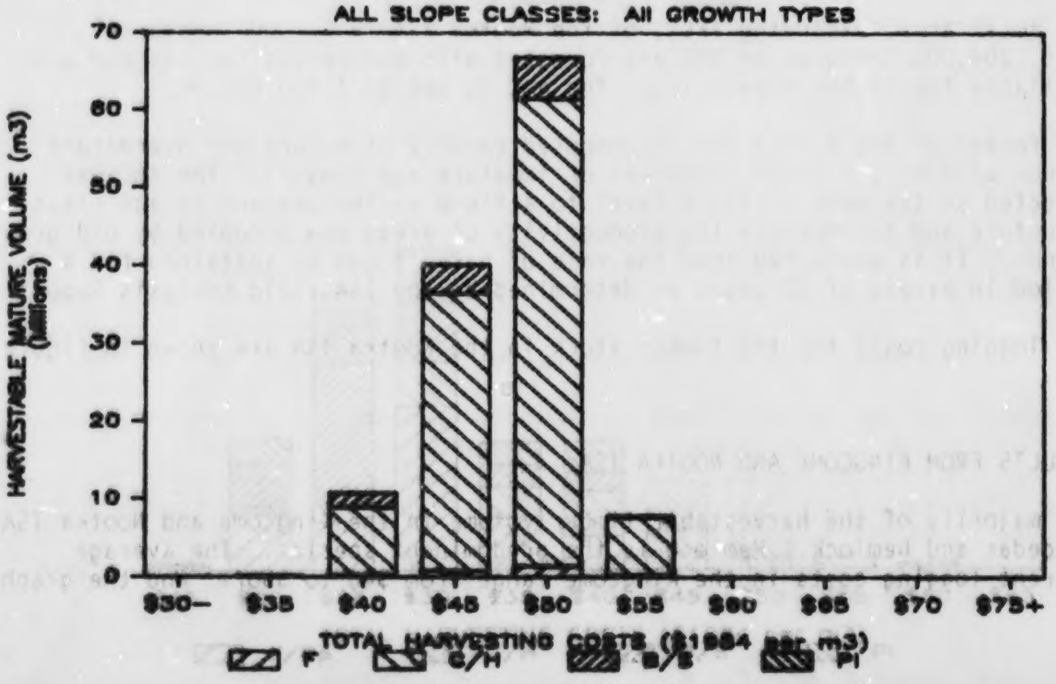
The logging costs for the timber stock in the Nootka TSA are shown in Figure H-5.

RESULTS FROM KINGCOME AND NOOTKA TSAs

The majority of the harvestable timber volume in the Kingcome and Nootka TSAs is cedar and hemlock. Hemlock is the predominant species. The average current logging costs in the Kingcome range from $40 to $50/m³ and the graph

Figures H-4 & 5. Logging Costs for Mature Timber: Kingcome & Nootka TSAs





seems to support this, with approximately 70% or 140,000,000 m³ at this level. Actual logging costs in the Nootka TSA average between $45 to $50 and about 85% or 105,000 m³ is at this level.

DISCUSSION

In general, the bar graphs and data from which they were developed can be considered as realistic pre-appraisals of the four management units. They should be quite representative of many other areas of the province as well, although the exact shape of the cost distribution may vary. It must be remembered, though, that the volume shown in the figures is the gross timber supply so the shape of the distribution is more important than the amount of timber that seems to be available. There are constraints on the mature timber supply that are not accounted for in this analysis including use of timber for non-harvesting purposes and use of multi-pass logging systems. These factors would make some of the wood in lower cost categories unavailable until well into the future. Other constraints such as allowances for damage from fire, insect and disease and for decay, waste and breakage would eliminate those volumes completely. Opinions of experienced staff are that the cost distribution would not only be shrunken by the 'netting down' factors, but also skewed to the right because a greater proportion of lower priced timber will be affected.

Also, the forest industry, as it enters watersheds to extract the most easily accessible and valuable timber first, could be left with second and third pass stands that are virtually uneconomic because they will require considerable capital investment for improving and developing road systems. This situation is aggravated when roads deteriorate during disuse and must be reconstructed at considerable expense. In this analysis, the road cost data used to construct the graphs could be significantly underestimated as it assumes a single pass scenario. Caution should be exercised, therefore, when interpreting the amount of timber that will actually be available in each cost interval.

It is evident that there is a significant volume of harvestable timber both above and below the average current experienced logging costs which conform closely with the peaks in the graphs. The data can thus be considered as a valid prediction of future timber availability at various logging cost ranges as long as present trends continue. The economic viability of logging that timber is naturally dependent upon selling prices, a component which was not considered in this analysis. To that extent, the figures presented here may be misleading if interpreted too literally. A unit with low logging costs but poor timber could be of lesser net value than another unit with better timber at higher cost. Experience indicates that there is little surplus value in today's harvests as exemplified by minimum stumpage rates; that situation is expected to worsen in higher cost stands which on average are of lower quality than what is now being harvested.

SECTION I

MAJOR ISSUES IN FOREST AND RANGE POLICY

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The previous sections of this report have addressed the extent and condition of forest and range resources, the effectiveness of present management programs and the outlook for British Columbia's forest and ranching industries. The discussions allude to areas where present policies or program levels appear to be misaligned or fall short of today's needs, where policy direction is ambiguous and where technical matters require further consideration. It is evident that numerous challenges must be met if the resources are to make optimal contributions to the province's economic and social well-being.

The intent in this Section is to describe the main areas where policy and program development appear necessary in the immediate future. While some possible alternatives will be identified, in most cases developing new directions will take several years of concerted effort by the Ministry of Forests and other parts of government. A key requisite will be to clarify the social and economic objectives upon which forest and range management should be focused.

Although the intent throughout this report has been to give balanced coverage of the three primary mandates of the Ministry of Forests -- timber, range and recreation -- timber has received the most attention. This results from both the relative importance of timber to the provincial economy and the more extensive knowledge about the resource in terms of inventory and biological relationships. The current depressed state of the forest industry and the long-term restructuring likely needed to restore financial viability further dictate the attention devoted to this sector. Likewise in this section, timber use and management will receive the most comprehensive coverage.

The issues have been broken down into the following topics:

Chapter I1. The Quality of Resource Management

Chapter I2. Nontimber Resources

- Ministry of Forests administration.
- Other agency administration.

Chapter I3. Timber Resources

- Biological extent and condition of forest resources.
- Administration and use of forest resources.
- Funding for forest renewal
- Outlook for the forest industry.
- Investment opportunities.

CHAPTER II

QUALITY OF RESOURCE MANAGEMENT

The broad policy issue facing the Ministry of Forests is to maintain an acceptable level of resource management in spite of the effects that the recent recession has had on both government and industry. Many efficiencies have been achieved through reorganization, application of computerized procedures and shifting of management priorities, but management objectives are still predicated on old expectations. This is particularly true with the current level of timber harvest.

The ability of the resource to support use while still being maintained in a sound condition depends on two conditions: investment level and management level.

The importance of the first is readily apparent. Timber harvests and range use in the long term cannot exceed the level at which these resources are renewed. As noted in the program discussions in Section E, present timber harvests are based on achieving greater management performance than has occurred over the past five years. They need to be brought in line with actual program performance, which should be a prime consideration during the next round of timber supply area yield analyses. These analyses should be based on actual program funding in the current year until such time as experience generates confidence that long-term goals will be attained. The other two resources, range and recreation, are less affected by investment level than by management level as discussed below, although funding problems were identified for them as well in the program descriptions.

The management level is critical to long-term resource productivity. Management refers here to the gamut of decisions from selecting appropriate site-specific treatments to monitoring results. It requires enough people, equipped with experience and up-to-date knowledge. The level of management can range from minimal, in which case broad guidelines govern prescriptions, to intensive where each site is closely planned and monitored. Either can be satisfactory depending upon the desired results and the risk associated with decision-making. A basic rule, though, is that minimal management must be accompanied by a conservative approach to resource use to maintain a sufficient margin of error to ensure that basic performance standards are met. For example, supporting over 900,000 AUMs of grazing on Crown range requires close regulation of stock distribution and regular monitoring of range condition, whereas two-thirds of that amount could be accommodated with less scrutiny.

With minimal management, general rules must be used to regulate activities rather than flexible prescriptions designed for local circumstances. The rules may not facilitate optimal performance, but they prevent detrimental effects on the resource base in most circumstances. In many cases, operating costs will be higher than could be attained under more intensive management. Because of the greater cost, the rules provoke criticism and demands that the ministry deregulate but the alternative is to abrogate legislated responsibilities for resource stewardship.

With present staffing trends, the ministry's role and the way it operates in relation to public expectations, interactions with the forest industry and integration with other agencies, will have to be rethought. Some of the alternatives are discussed later in this section. As with program funding levels, objectives need to be redefined to bring them in line with staff capabilities; and that may entail more conservative resource utilization to ensure that long term production capabilities are maintained and that environmental and other resource values are not abused.

CHAPTER I2

NONTIMBER RESOURCES

Integrated resource management was discussed extensively in Section F. By and large, a wide variety of resource uses are successfully incorporated in forest and range land management. However, program interactions absorb an increasing proportion of staff time, both within the Ministry of Forests and in other agencies, and recent staff reductions will require changes in the negotiating processes that have evolved over the years. Also, since the forest industry has had to reduce costs to remain financially viable, the operating constraints imposed to protect the environment and to foster other uses need to be re-examined. Other trends such as the shift in age and species structure of the forest resource, depletion of old-growth stands and expansion of logging into previously untouched areas continue to challenge traditional prescriptions for program integration.

Compounding these difficulties are changing objectives for resource production and priorities as to whether provincial or local interests will prevail in resolving site-specific conflicts. The latter is especially important when the public is involved because representation is usually heavily weighted toward those whose interests are clearly affected by the decision under consideration. Interests of the community at large are more difficult to identify unless they have been explicitly defined as a government social policy. As a result, well-meaning planning efforts involving the public may be changed by government which is responding to a different perspective on resource priorities.

Many integrated management decisions today are merely compromises since inherent conflicts remain in the management objectives for the various resource sectors. With a large resource base, conflicts among resource uses can often be avoided temporarily by one use moving elsewhere. The problems, however, remain and must be faced in the future, a future that is no longer very far over the horizon. This means that integrated resource use policy will soon emerge as a central political topic, imposing more and more demands for senior levels of government to become involved in development issues. Therefore, it would be advisable to begin enunciating general resource use policies for each region, even though this might, in the short-term, escalate differences between resource users when they understand the properly defined range of choices. Certainly these policies are needed to promote efficient resource use administration and to design optimal prescriptions for integrated management.

The above statements apply equally well to the nontimber jurisdictions within the Ministry of Forests as to resources under the administration of other agencies. Although having timber, range and recreation under one roof could facilitate integrated management, it does not in fact do so completely because decentralization of responsibility has spawned a wide range of interpretations that guide trade-offs, program emphasis and staffing and funding allocations. Now that further delegation of responsibility to the forest industry is under active consideration, it is even more important that specific policies are enunciated that clearly specify the objectives to be met.

In establishing regional resource use priorities, known conflicts of objectives should not be taken to lower levels of planning where they will continue to frustrate efforts to achieve integration. Options need to be identified and choices made either by elected government or by a body delegated responsibility for these decisions. Possible questions to consider in policy development include:

- Should the lead agency approach, as used at lower planning levels, be extended whereby the Ministry of Forests, in consultation with other agencies, industries and the public, would identify alternative sets of regional priorities for the Environment and Land Use Committee of Cabinet to consider?

- Would a variation on the above be feasible whereby government would appoint a board of senior advisors made up of a cross section of interests to advise government?

- Would an interagency body be effective in developing regional options with decisions made as in '1' or '2' above?

- Could the present approach to planning without identified objectives become more effective if there was added emphasis on conflict resolution, possibly involving some neutral party such as an arbitrator?

In addition to the global issue of resource use priorities, other more specific issues related to non-timber uses should be addressed.

RANGE MANAGEMENT

Historically, range management has emphasized soil and forage conservation by regulating use under a variety of tenures. More active management has been introduced in response to increasing demands on the resource but these practices are still in their infancy. A notable deficiency is the absence of an inventory of range carrying capacity and condition to guide management decisions. An inventory is now being planned but efforts must be made to bring it to completion quickly, at least in high use areas.

Knapweed is an expanding threat to open rangelands. Present containment efforts are insufficient to protect even the highest priority ranges and knowledge about extent and trends of infestation is less than needed to select areas for treatment or to monitor results. The alternative to developing an effective control program is to sacrifice these grazing opportunities until a natural or introduced agent eventually emerges to suppress knapweed. Considering the value of the resource and the cost of treatment, expenditure on a containment program appears to be the better choice.

Other issues and investment opportunities are discussed in Section E.

RECREATION MANAGEMENT

The growing public interest and concern about environmental, recreational and scenic values indicates the need to place more emphasis on social factors in the course of managing the forest resource. This is particularly so around population centers, main transportation routes and surrounding highly utilized recreation destinations. Without appropriate social emphasis, polarized confrontation between the public and the forest industry can be expected.

The Recreation Management Program has been reduced considerably over the past few years to the point where existing facilities cannot be maintained let alone develop new ones to meet increasing demands. As sites deteriorate, recreationists will disperse into unserviced areas where garbage and sanitary conditions will deteriorate and risks to the forest and range resources will escalate.

Increasing use of the grazing lease tenure raises questions about public access for recreation. While considerable debate has been generated about the extent of public and private rights under the current policy, conclusive answers have not emerged; this will need to be clarified if future controversy is to be avoided.

OTHER USES

Issues related to other agencies' programs are dealt with in Section F. In addition to the need to establish resource use priorities, as already discussed, principle issues include rate of harvest within defined areas such as watersheds, retention of old-growth forests where they are desired for wildlife habitat or ecological diversity and protection of community and agricultural water supplies.

Above all, other management agencies want to see integrated management prescriptions given more formal recognition than at present to ensure that nontimber resource uses are adequately protected. In particular, other agencies are concerned about priority areas for their programs being included within Provincial Forests. The plans developed for integrated use are viewed as too informal to afford protection for these areas and there are suggestions that jurisdiction should be formally transferred. Even where timber values are marginal, demand for timber could develop and logging might proceed to the detriment of other resource values.

As discussed in Section F, the Ministry of Forests views a fragmented forest land base as contrary to efficient integrated use, but the provisions for other uses could be formalized particularly in areas where uses other than timber are determined to have priority. Policy questions include the following:

- Should consideration be given to creation of Protection Forests over areas of low timber-producing potential and areas of prime nontimber uses? The Environmentally Sensitive Area classification has already been used for this at times but it is not really suitable. Logging in Protection Forests might only proceed after review similar to that required to delete lands from Provincial Forests, and then only according to methods that satisfy the objectives of any high priority, nontimber uses.

- Would further interministerial protocols be an effective substitute for formal land designations in dealing with nontimber uses on extensive areas of marginal forest lands?

CHAPTER I3

TIMBER RESOURCES

EXTENT AND CONDITION OF FOREST RESOURCES

This chapter addresses the relationship between the resource and management policy. This approach does not assume a "best" condition for the resource, but rather recognizes that our management choices range from exploiting a naturally occurring timber supply to maximizing production through investment in intensive management. This set of choices implies different short and long-term expectations for harvest rates and economic viability of the forest industry. What is evident from this analysis is that the present forest resource cannot, without significant changes in management policies and programs, continue to support current harvest rates and still meet the long-term objectives of sustained yield.

The yield analyses, on which allowable annual cuts are established, contain specific assumptions about how much of the present timber inventory will be available for harvest, how quickly new crops will be established following logging or wildfire and how much growth will occur in second-growth forests. The result is a set of options that portray various choices for present harvest rates in relation to their implications for the future. The Chief Forester selects each allowable annual cut based on an assessment of the assumptions about management practices and consideration of government's objectives for social and economic development. It is, therefore, of concern when actual management practices fall short of those assumptions.

Of primary importance is the assumption of basic forestry which is the minimal standard of forestry practice deemed to be necessary to achieve the level of resource stewardship demanded by the Forest Act. What it entails is quickly re-establishing well-stocked thrifty young stands after forest lands are denuded by logging or wildfire. As discussed in Section C, reforestation is not meeting that objective and brush competition and insect pests are curtailing growth of established stands. Consequently, long-term harvests will fall below projections and thereby aggravate the decline or fall-down from present harvest levels.

With a resource like timber, where the renewal period is so long and the annual harvest is such a small percent of the total supply, the consequences of inadequate forestry may not be apparent in the short term. Therefore, actual performance must be incorporated into yield analyses and thereby reflected in allowable annual cuts in order to make rational decisions about how harvests should be apportioned over time.

The same is true of intensive forestry. Typically, a yield analysis will indicate that maintaining short-term harvest rates near present levels will cause a precipitous dip or hole in the harvest schedule after two to five decades, rising to a more or less sustainable level later on. Part of the deliberation over setting an allowable annual cut includes the likelihood of overcoming this deficit through intensive forestry. Because the hole in the supply curve represents a shortage of timber of harvestable size, a solution requires immediate action to advance timber growth to adequate dimensions by the time it is needed. Current intensive management programs fall short of resolving the problem and will not achieve the performance anticipated when allowable annual cuts were established.

The effects of brush and insect pests may or may not cause further shortfalls in performance depending upon how completely they are already incorporated into the growth and yield curves in the yield analysis models. The curves now in use are derived from natural stands which would have been affected to some degree by growth suppression from competition and pest damage: how far they are below an optimal growth performance has yet to be determined. In any event, neither problem has been addressed as well as was anticipated in the 1980 Forest and Range Five-Year Program and, therefore, will cause a shortfall in expected performance. To the degree that harvest levels were based on those expectations, timber supply objectives will not be met unless the problems are resolved.

The policy questions are rather straight-forward and obvious, but they have major social and financial implications. They are:

- Should investments be increased to a level commensurate with the sustained yield objectives underlying current harvest rates?

- Should harvest rates be reduced to a level that permits the pattern of the chosen harvest schedule to be restored under the present level of funding?

- Should harvest rates be maintained as they are at present but accept that future timber supplies will be less than indicated in the ministry's long-term plans and that periodic supply deficits could occur?

- Should regional priorities be established whereby any one of the three above choices could be implemented in individual timber supply areas according to government objectives for those areas?

Another measure of the condition of the timber resource is its economic profile. Historically, management and administration has focussed primarily on the volume of timber available for harvest. Value is recognized through the stumpage appraisal system whereby stands with higher net value return more revenue to the province; however the amount or flow of these revenues is not determined by specific objectives. Rather, it is merely a consequence of other decisions, primarily those of selecting where current harvesting will take place. Value is also incorporated in a crude way into yield analyses by defining timber as operable or inoperable depending upon the likelihood that it will be logged profitably sometime within the current rotation period. Thus, the timber in the long-term supply varies from what can be harvested at almost any time to what is profitable only in market cycle peaks. That supply profile will have important implications for industry's ability to sustain operations on a continuing basis and for the generation of stumpage revenues.

Chapter H3 assessed logging costs for the mature timber supply in a sampling of timber supply areas in the Kamloops and Vancouver Forest Regions. These units were selected to represent different timber types and operating conditions and to indicate what might be encountered elsewhere in the province. In each case, a significant portion of the wood supply needed to achieve long-term harvesting objectives is economically inoperable under today's market conditions and will remain so even when prices rise to what might be considered normal levels. That means that operations must be shifted into marginal timber whenever markets permit.

At present, logging operations are largely confined to timber with the highest net value and even then, stumpage returns are at minimum rates. Forecasts are for this condition to continue for several years more, even after markets begin to improve. That the high value end of the supply is being depleted becomes an inescapable conclusion when the species and locales of present operations are considered. Relaxed utilization standards aggravate this problem by increasing the area cut to attain the same volume of harvest. In effect, the long-established trend to take the best first has been accelerated, leaving lower quality wood to be addressed when the price of forest products increases or when new technology allows cheaper logging and manufacturing. But whether either factor will materialize is unknown. Unless current trends undergo a major reversal, the lower valued wood supply will be faced in economic conditions that are no better, and likely worse, than those experienced in the past. New technologies such as air-lift systems are being developed but they probably will not keep pace with rising costs. Strategies to make the most of the marginal wood must, therefore, now become an intrinsic part of forest management planning.

Access is one of the main problems to be overcome. Logging requires roads, and much of the marginal timber is inaccessible from the present road system. Not only have roads not been built into remote areas, but in some areas first-pass logging has removed higher-value timber leaving only low-value stands to underwrite the cost of building new roads or to restore the usually deteriorated road system already in place.

Futhermore, the recession has curtailed road building. Immediate cost savings have been attained by reducing annual road construction to as little as one-third of what is needed to promote rational development of the full supply profile. Even if markets were to turn around tomorrow, it would be difficult for the industry to reach out into low-value stands because of the time needed to extend road systems.

A policy initiative is urgently needed to reconcile what is actually being logged now with what will be required to fulfill objectives for long-term timber supplies, both in terms of available volume and generation of revenues. Questions to be addressed include:

- Should the volume of timber allocated under long-term commitments be reduced to a level commensurate with what could be harvested under sustained average market conditions and additional volumes of low valued wood made available through competitive sales?

- Should a higher relative minimum stumpage be set on good quality timber to ensure that the province obtains an optimal return from the resource and to discourage its rapid depletion during poor markets, as has occurred with recent record level harvests in the interior?
- How can the province better assert its interest in determining how management units will be developed to ensure that the entire timber supply will be extracted in a rational manner?

ADMINISTRATION AND USE OF FOREST RESOURCES

The administration of forest resources has been so closely tied to regulating the use of a biologically defined supply that it is difficult to distinguish administration per se from the extent and condition of the resource. For example, setting the allowable annual cut for each management unit is a principal administrative decision, but it has major implications for the extent of the resource as has already been discussed in relation to supply variables. There are, however, some important administrative policies that warrant specific attention here. These include: the extent to which government conveys timber rights through the tenure system; the trade-offs between attaining maximum harvest levels and other objectives such as community and employment stability, industry competitiveness and revenue generation; the manner in which long-term resource stewardship is addressed in silvicultural standards; and the roles of government and industry in managing the resource.

SECURITY OF SUPPLY

The Crown timber resource has been totally committed under a variety of tenures, all of which provide extensive rights to timber supplies extending well into the future. This system has its roots in a policy which provided supply incentives to encourage the industry to expand to the limits of available supply. As was demonstrated in the 1979 Resource Analysis and borne out in this investigation, the policy has been immensely successful to the extent that present efforts must be focussed on maintaining a sufficient supply to sustain the industry.

Over the past five years, considerable efforts have been made to enable innovative new entrants into the forest industry through the Small Business Enterprise Program; to date 7% of the annual harvest occurs under this program. Enlarging this program would increase the amount of timber subject to competitive bidding.

A feature of most forest tenures is that they are volume based and do not specify the value of timber to which the rights pertain. This is in contrast to tree farm licences where the tenure is area-based and the timber supply is clearly what lies within the management unit. A policy problem is posed where tenure holders wish to exert their rights to volume in better quality stands thereby leaving lower valued timber for the future; or conversely, where timber management objectives such as salvage of beetle-killed timber require

moving some operators into very low valued timber. Two key questions to be addressed are:

- **How can rights to harvest specific volumes of timber be brought into line with the broad value profile of the timber resource to prevent progressive down-grading of the resource?**
- **Is there an equitable means to direct some operators into problem stands as necessary to satisfy forest management objectives?**

CUT CONTROL

Cut-control policies were designed to ensure that harvests authorized under the tenure system were attained. They incorporate employment stability as an objective by setting limits on how low harvests are allowed to drop during poor markets and requiring corresponding increases during better times so that the allowable annual cut is achieved over a five-year average. Harvests are permitted to vary by plus or minus 50% of the allowable annual cut over one year and by plus or minus 10% over five years. Although a lower limit is set, the provisions for compensatory increases in harvests still allow considerable fluctuations in employment levels. In addition, ministerial prerogative has been exercised to grant relief where continuing operations during the recession would have placed some segments of the industry in irreversible financial difficulties.

Significant policy questions to be addressed include:

- Are the underlying objectives of cut control being met and is the present policy the most effective way of meeting those objectives?
- Do the peaks in harvest above the AAC, as now required to offset deficits in previous years, constitute productive use of an increasingly scarce resource?
- Are there areas of the province where community and economic stability should be given a higher priority in harvest level and cut control decisions?
- Are there other areas where the economic advantages of rapid short-term harvests should be promoted?

STANDARDS OF SILVICULTURAL PRACTICE

British Columbia is still involved in the harvest of old growth stands but the inevitable change from a forest economy, based mainly on harvest of old growth forest to one based on second-growth management, has a number of implications for administrative policy and is already having a significant influence on silvicultural practice. Among the many specific issues related to silvicultural practices, two will be discussed here: how to keep forest land productive and how to maintain environmental and aesthetic values.

Silvicultural control is exercised through harvesting plans rather than through legislation. This approach provides maximum flexibility but it requires Ministry of Forests staff to be directly involved in operational matters. Staffing reductions and the possibility of delegating further responsibility to the forest industry may require a more formal policy regarding silviculture standards.

At present, some foresters are concerned that the level of reforestation enabled under the Ministry's Five-Year Program does not satisfy basic forestry requirements, even through the plan contains an objective of escalating nursery production and planting to more adequate levels. Decisions about how much will be planted in each management unit are largely determined by budget allocations rather than by specific management requirements. A move is underway to conduct preharvest assessments that will establish silvicultural objectives before logging begins. These assessments cover all aspects of silviculture from logging prescriptions to site treatment and subsequent reforestation objectives. A solid policy must be established to define responsibilities for performance and funding and to provide a basis for monitoring and enforcing those standards.

In jurisdictions where most forest land is in the public domain, there may be little incentive to encourage good forest practices on the small percentage of private forest land. However, such private lands tend to be concentrated in productive lowland areas and, even though they make up only about 4% of British Columbia's productive forest land, they currently account for a significantly larger fraction of the annual cut. In local situations, private lands may dominate the tenure pattern but at present there are no means to ensure that forestry practices on these lands are environmentally sound.

Primary policy considerations related to silvicultural standards include:

- What is the best method to utilize the skills of foresters in industry and government to maintain appropriate silvicultural standards on forested lands?
- Should means be examined to protect environmental and aesthetic objectives and to promote sound forestry practices on private forest lands?

DELEGATION OF MANAGEMENT RESPONSIBILITY

The idea of delegating management responsibility for publicly owned renewable resources has met with ever-increasing acceptance since the late 1970's. At the First Ministers meeting in February 1978, it was agreed that "the burden of government regulation on the private sector should be reduced". Now, many believe that better solutions to a wide range of problems lie in both industry and government having management responsibilities, rather than industry being solely responsible for meeting performance standards and government acting in the traditional role as regulator.

The distinction between regulator and manager is not an academic one. The government as regulator is seen to be reactive and policeman-like, dependent on legislatively defined standards, rules and penalties to enforce specified performance. In contrast, government as manager is seen to be co-venturer with the private sector, with its main responsibility being to ensure that various public interests are served in the management of natural resource developments. In practice, government find itself carrying out both roles - regulator and manager.

Delegating forest management responsibility to the private sector is an alternative that cannot be ignored because of the very nature of today's forest industry. Sound forest management has become an integral part of their efforts to ensure continuity of wood supply in support of their large capital investments. Because of this evolution, it is argued that the forest companies now have the longer-term perspective needed to plan for the raw materials they will need 80 years hence and should therefore take full responsibility for managing the forest. While that argument might contain some truth, it is doubtful that industry's objectives would always coincide with the public's interest, especially over the full range of forest resources. Therefore, there is clearly a role for government in setting policies and monitoring performance.

The present policy is to increase the role of the private sector by assigning industry more responsibility and accountability for managing certain types of harvesting agreements. Such increased responsibility is viewed as an earned privilege based on past performance and is not automatically included in all tree farm licence agreements. A company must have displayed a strong commitment to sound forest management practices and used an integrated approach to the management of all forest, range and recreational resources on the licence area.

The focus of any delegating mechanism must be on how to make effective use of industry's managerial skills, while recognizing the conflicting interests of the private entrepreneur and the public owner of the resource. To do this, policies must be developed that clearly state the extent to which industry can pursue its own objectives; the resource use objectives and priorities that must be met within the management area; the measures that will be used to monitor performance; and the consequences of failing to produce required results. Delegating responsibility could pay off in better forest management, but the above policies must be clearly defined.

Questions to consider in policy development include:

- Are there areas of forest management where the objectives of the forest industry and the public will be aligned closely enough to allow full delegation of management responsibility?
- Are there other areas where the public interest should be embodied in regulations that clearly specify performance standards?
- What is the most effective balance of roles between industry and government in sharing responsibilities of forest management?
- Should forestry practices on private lands be included within regulation of silvicultural standards?

RESPONSIBILITIES FOR FUNDING FOREST MANAGEMENT

The economic downturn during 1981 and 1982 has brought into sharp focus a question of fundamental importance: What mechanisms are available to ensure that annual investments in forest renewal and management are maintained when forest revenues are down? One mechanism initiated with limited success was the Forest and Range Resource Fund. During the years when this source of funds was available, ministry programs were maintained at higher levels than they would have been without it. The fund was quickly depleted, however, leaving long-term forestry program objectives either in abeyance or underattained.

Section 88 of the Forest Act was intended to encourage silvicultural investment by providing a credit to stumpage for work done on a management area. This approach has not been as successful as hoped because it is market sensitive. Inevitably, forest revenues and forest expenditures are linked and when forest revenues dry up, even silvicultural treatments that qualify for Section 88 may not be pursued unless they are enforced as a condition of the licence.

A dominant theme in today's debate on funding alternatives for forest management is co-operation between federal and provincial agencies. A cooperative approach is exemplified by the success of the recent federal-provincial Employment Bridging Assistance Program. Although considerable progress has been made in recent funding agreements, more work is needed to develop a policy that will clearly establish responsibilities for the future.

The Canadian Institute of Forestry recommended to the Royal Commission on the Economic Union and Development Prospects for Canada that federal-provincial forestry co-operation be put on a new basis that emphasizes clear definition of roles and long-term commitments. A similar point was made by the Canadian Federation of Professional Foresters' Associations who suggested specific federal and provincial responsibilities. These suggestions would remove forest management funding from the short-term agreements as now negotiated between federal and provincial governments.

Policy questions include:

- Should the public, as owner of the resource, continue to be responsible for the costs of its management?
- If so, what mechanisms are available to ensure that the fees charged for use of timber cover the necessary costs of its management?
- If the forest industry is delegated greater management responsibility, should that also entail responsibility for reforestation and other management costs?
- Are there feasible incentives that could encourage the forest industry and others to invest private funds in forest renewal?

OUTLOOK FOR THE FOREST INDUSTRY

The future of the forest industry was given detailed coverage in Chapter H1 and is dealt with further in the summaries of consultants' reports in Section J. Problems and opportunities have been identified but the consultants have not offered any easy solutions. Industry restructuring is inevitable with or without government intervention. As the industry evolves to cope with new market realities, there will be casualties, primarily the obsolete or financially troubled components. Government action to save employment and underwrite community dependence will serve to perpetuate inefficiencies and probably burden the remainder of the industry as it strives to survive. Strong determination will be required to withstand the pressures to subsidize the traditional industrial structure as a social program, but the province will benefit more in the long term by policies that enable and encourage restructuring as quickly as possible.

There are many policy questions to be formulated and addressed over the next few years. Two immediate issues related to the future of the forest industry that are of significance are:

- To what degree should government become involved in directing the changes in forest industry structure and product profiles?
- Should stumpage prices remain low to avoid financially burdening a struggling industry or should realization of potential revenues from timber take precedence?

INVESTMENT OPPORTUNITIES

The relevant question here is how the level of timber harvest will respond to investments. A confusing array of predictions abound in both technical journals and popular media. Some promise twofold to threefold gains through intensive management; others project that major investments will just maintain present harvests. The contradictory positions arise from different starting conditions, from comparing growth of individual sites with growth of the whole forest, as well as assuming differing responses to specific site treatments.

For this report, an investigation was undertaken to estimate how harvest levels from the province's forests would change given various investment options: from doing nothing to undertaking all feasible projects. The results proved interesting, but must be interpreted carefully for a number of reasons.

First, as pointed out in Section C, responses to intensive management are not based on definitive operational studies. Therefore, there is a degree of uncertainty associated with any harvest predictions based on these estimates. The figures used in this report are on the conservative end of the scale of anticipated responses, but a monitoring program could reveal that the vagaries of operational conditions will inhibit achievement of results similar to those in controlled research plots.

Furthermore, responses to intensive silviculture depend upon what is available for treatment. Basic silviculture can be applied only to sites being denuded today and those sites differ from what was logged or burned in the past and what will become treatable in the future. Similarly, opportunities for intensive management are limited by the age and condition of second growth forests, which depend on harvesting schedules, sporadic fire history and even intensive programs undertaken to rehabilitate backlogs of problem sites.

The estimates that follow, therefore, predict only how much timber will be available for harvest when present immature stands reach maturity, but they tell nothing about what will occur in the intervening 80 to 90 years. In particular, what is discussed below does not imply a solution to mid-term deficits predicted in the first Resource Analysis or in subsequent yield analyses for Timber Supply Areas.

With these qualifications, the results give a reasonable picture of what a silviculture program can buy.

The analysis was done region by region and for individual treatments but only the provincial totals for all treatments are discussed here. Yield at rotation falls to less than 50 million m^3 if logged areas are all left to regenerate on their own without subsequent treatment, and appears to have an upper limit of nearly 100 million m^3 under a full-blown intensive silviculture program. At an intermediate level of silviculture based on the fifth year of the 1982 Five Year Program, the yield at rotation would be just over 75 million m^3. Response at the present program level was not calculated, but it falls well below this intermediate option.

The analysis shows that the response to a major silvicultural program would be significant compared to neglecting the resource, offering a twofold range of timber supply in response to choice of investment level. It should become increasingly expensive to generate additional volume as progressively lower priority areas and treatments are drawn in but the predictions are not precise enough to generate definitive investment response curves. Apparently, though, the cost per m^3 is relatively constant over a wide range around current program levels, which indicates cost-effective treatments could be undertaken if these are required to attain regional timber supply goals.

A pest control program also has inventment potential beyond that predicted under the silvicultural options. The forest pests considered here are insects and diseases that can cause tree mortality and growth losses. (Control of unwanted vegetation is already included under brushing and weeding in the intensive silviculture options and as such is incorporated in those predicted growth responses.)

Insects such as bark beetles cause direct mortality to mature and overmature conifers, notably lodgepole pine and spruce and, thus, directly reduce the available forest inventory of merchantable trees. Defoliators, mostly moth larvae, cause increment loss and some levels of mortality. Other insects destroy seedlings, root systems, seed and cones and terminal shoots.

Major disease organisms include mistletoes, root rots, rusts and stem rots. Losses from some pests, particularly mistletoes and root rots, are difficult to quantify as their effects cause increment losses over long periods. On the other hand, losses from pests such as bark beetles are more easily quantified since their activity results in speedy mortality and is easily detected. However, expansion of such infestations are unpredictable and average losses over a rotation are difficult to assess.

The 1982-83 Ministry of Forests Annual Report estimated the annual losss to pests, excluding brush, amounted to over 27 million m³ which is equivalent to 44% of the volume harvested in the same time period. Much of this loss was from bark beetle infestations which will continue to have a critical impact on the availability of merchantable timber over the next decade in some management units.

Realizing the potential of pest control will require attention to the following issues:

1. The need to develop a way of ensuring that the forest industry harvests stands susceptible to an escalating bark bettle infestation, both for control and salvage purposes. To do this, certain problems need to be overcome: extensive harvesting in localized areas may be at odds with other land use objectives; the industry will have to accept a large proportion of low value timber; costs will be higher at manufacturing plants because of disrupted species and log diameter mixes; and allowable annuals cuts might have to be reduced in some management units.

2. The social attitudes toward the use of pesticides in forestry. When the use of certain chemicals such as phenoxy herbicides is restricted, forestry practitioners have few practical alternatives left. The required changes in policy and processes include improving the training of forest workers in the use of pesticides, improving delivery abilities of application equipment, upgrading capabilities to monitor and chemically analyse treated areas and streamline the cumbersome system for processing permits.

3. The need for emergency funding to increase the effectiveness of pest management activities. Rapidly spreading outbreaks can be deactivated if the proper counter measures are applied quickly, but this requires a funding policy whereby unplanned, unbudgetted programs can be mounted rapidly, as in the control of wildfires.

Other areas of program development are covered in Chapter E4.

SECTION J

SUMMARIES OF REPORTS
PREPARED TO ASSESS THE OUTLOOK FOR
BRITISH COLUMBIA'S FOREST INDUSTRY

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CHAPTER J1

SYNOPSIS OF WORLD SOFTWOOD TIMBER SUPPLIES

EXECUTIVE SUMMARY

The purpose of this report is to provide a synopsis of world softwood resources, with an emphasis on the prospects for incremental production from regions which compete most directly with British Columbia. The following highlights are taken from the chapters of the report in the same order in which they appear.

British Columbia in a Global Context

This province exported $5.5 billion worth of forest products in 1983, about the same value as each of Sweden and Finland but substantially more than Russia. This record of accomplishment is based on a resource of high quality and a competitive industry.

Different Kinds of Projections

The confusion which often accompanies timber supply projections is due to a failure to distinguish three different concepts: biology, policy and reality. In more specific terms these measures are as follows:

1. Biological capability of forest land.
2. Timber production targets set for policy purposes.
3. The likely performance, recognizing the reality of economic and other constraints.

This report recognizes the necessity of gauging country outlook studies accordingly.

FAO Timber Projections

Benchmark projections by FAO indicate an increase in the supply of softwoods for industrial use of 385 million m^3 between 1980 and 2000. This compares to a production in British Columbia currently of slightly over 70 million m^3. The FAO figures are now believed to be unrealistically high, for reasons noted in the report.

United States

In 1982, the U.S. Forest Service projected that their softwood timber supply would increase by 72 million m^3 between 1976 and 2000, most of this coming from the U.S. South. This is now believed to be too high a target, given the low management performance on nonindustrial forests and other constraints. The increase cited should be discounted by at least 50%.

Europe

The Nordic group is close to its timber supply ceiling and other regions are constrained in such a way that the volume increase in supply will not reach that projected in 1982 by the FAO Working Party or by an earlier ECE/FAO Timber Committee. The FAO's projected increase of 56 million m^3 by 2000 is no longer considered realistic. The acid rain threat to European timber availability appears to have been exaggerated, at least insofar as the next 10-20 years are concerned. The mountain pine beetle and spruce budworm are much more devastating in Canada, in both absolute and percentage terms.

Russia

The Russian forested area and its potential softwood supplies have always been overstated in relation to North America and Europe. The exploitable area of Russian softwood is well under half the total classified as forest land. On this exploitable area the estimated sustainable output is around 325 million m^3, which is only slightly above the 1980 harvest. The FAO projections for the year 2000 are much too high. Russia does not represent an increased threat to British Columbia.

Japan

The hopes and expectations of the official Japanese Forestry Agency have been proven repeatedly to be overly ambitious. Their striving for increased self-sufficiency is frustrated by high domestic costs and the more competitive timber products from North America and elsewhere. They will continue to be a prime market for this province's lumber, although log imports from the U.S. and elsewhere have reduced British Columbia's opportunity in Japan.

Latin America

Tropical Latin American forests are not a significant problem to British Columbia. The plantations of Brazil are geared principally to pulpwood production. Chile's softwood afforestation does represent a potential threat, especially in Pacific Rim markets. However, the periodic political upheavals and other constraints have made it difficult for Chile to live up to its policies and plans. Investment capital is difficult to attract and they are forced to leave radiata pine on the stump beyond cutting age or to export it as roundwood. Latin America is not the ominous threat many have assumed.

Tropical Africa and Asia

These regions have been too busy with domestic timber deficits to present a problem for British Columbia or other softwood regions. The most effective plantation program is in the Republic of South Africa, but their primary goal is self-sufficiency.

Oceania

Australia has an excellent plantation program but the majority of species are hardwoods. Their softwoods are designated primarily for domestic use, which will, of course, replace some of British Columbia's exports to Australia.

New Zealand is a newly arrived competitor and will increase its sales into our Pacific Rim markets in the next two decades. The incremental volume projected by the New Zealand Forest Service is about 14 million m^3. This is probably a reasonable figure, but as much as half of this could be exported to the Orient as roundwood.

Other Areas

Canada east of the Rockies does not enjoy a net reserve of timber available for expansion. The accessible timber within economic range of existing mills is modest in volume and less attractive by far than what is currently harvested. Moreover, shortages of sawlog material are now evident in every region of the country.

China could furnish material for an interesting chapter, not because of the potential for increased softwood supply, but for the very opposite reason. Their softwood forests are heavily over-committed and require substantial rehabilitation. Meanwhile they represent an expanding market of significant potential for British Columbia.

Summary of Projections

A summary statement would show that incremental supply of industrial softwood should be one third lower than that projected for 2000 by the FAO Working Party. Coupled with these reductions in available timber supply will be a parallel drop in consumption of forest products. While the product demand side is not examined in this report, those who are preparing the next series of timber trend studies have already signalled lower targets for the years ahead. Moreover, it is the majority view that the consumption of softwood lumber will, in fact, be constrained by diminishing availability of prime sawlogs in most producing areas.

For the purposes of this study, however, it is safe to conclude that British Columbia will not find its markets, for either lumber or fiber products, swamped by competing plantations or by intensively managed natural forests in other countries. The only prudent course is to regard British Columbia's forest resource as a major natural asset which will increase in value. It should, therefore, be managed more intensively and with a confident eye to the future.

CHAPTER J2

SECONDARY MANUFACTURED SOLID WOOD PRODUCTS IN BRITISH COLUMBIA

EXECUTIVE SUMMARY

It is generally recognized that some of the best opportunities for growth for British Columbia's forest industry lie in the development of more valuable products from the resource that exists. Consequently an analysis of secondary manufacturing of solid wood products in British Columbia was undertaken. The work was carried out by Woodbridge, Reed & Associates in July/August 1984. The objectives were to identify the current activity relative to secondary manufacturing, to review the constraints and to outline the potential for development.

Secondary manufacture was defined as being any processing activity that is outside the normal framework of a primary sawmill. The industry sectors investigated were:

- secondary manufacturing industries producing specific products such as doors, windows, furniture, kitchen cabinets, prefabricated houses
- remanufacturers processing lumber from one form into another
- primary sawmills where there is some separate processing activity that results in the production of a specialty product (e.g. fingerjointing, sidings, panelling).

The secondary manufacturing industries employ close to 7,000 people and have been expanding in recent years. However, these industries are primarily oriented towards domestic consumption with only 5% of production being exported. Furthermore, apart from the industries related to construction, relatively little solid wood from British Columbia's resources is used. Many of the companies are small and lack the equipment and infrastructure to expand significantly into export markets. The variety of specifications and fashions demanded in each export market is a further constraint. It is concluded, therefore, that apart from some specific industries such as kitchen cabinets, the opportunity for substantial export volumes of the products produced by the secondary manufacturing industries is not great.

There are about 65 companies engaged in remanufacturing - 75% being on the coast. These companies process over 500 million board feet of lumber from British Columbia's sawmills at a sales value of around $200 million. The products vary widely from edge-glued boards to spindles to ladder and door stock. The principal constraints facing the remanufacturers are:

- raw material supply (no long security and the wrong sizes)
- lack of financial strength
- too small to develop major export programs.

The strengths of this sector lie in substantially greater production flexibility, together with a more entrepreneurial approach and a lower overhead/labour cost structure.

With the exception of the cedar mills where there is already a substantial amount of secondary manufacture, British Columbia's sawmills concentrate on the production of primary products. The majority of the mills, particularly in the interior, have developed production techniques that emphasize a cost minimization approach. They depend on high volume throughput of standardized items. This approach is essential for the mills to operate economically but limits the flexibility to extract products that may command higher value through secondary manufacture. On the coast, sawmills also cut for value on the outside of the log when this has the potential to yield better quality lumber. The balance, over 80%, is cut into sizes that are compatible with the sizes demanded for construction grades.

It is estimated that, for hemlock, a further 15 to 20% of higher value product could be extracted. The Council of Forest Industries is currently developing new grading rules which take advantage of this potential relative to the lumber qualities required by industrial consumers worldwide.

In the interior, the quality of the resource would allow substantial volumes to be extracted for sale to industrial consumers worldwide at prices in excess of construction lumber. In order to capitalize on this opportunity the species must be segregated. Lodgepole pine, in particular, offers excellent potential for the production and sale of higher value products.

Markets exist, or can be developed, for the higher value products that can be manufactured but fundamental changes in production and marketing approaches are needed. Close relationships between producer and consumer have to be developed and a value, not volume oriented approach to manufacture has to be adopted.

The very real production cost constraints at the primary sawmill suggest that the development of greater volumes of higher value products may depend on the lower cost remanufacturing sector. Greater coordination and cooperation between the primary sawmills and remanufacturers would overcome many of the constraints faced by both sectors and take advantage of the strengths each can offer.

It is estimated that the value of higher grade lumber that could be sold in specialty sizes and grades and components could be increased to $1 billion annually, from the current $500 million. Substantial added value could be obtained and over 5,000 jobs would be created directly.

New initiatives and incentives at both the private and public sector levels are needed to capitalize on this opportunity. Areas that need to be explored in greater depth include:

- research and development effort related to new remanufacturing technologies;
- an evaluation of the effectiveness of the Small Business Enterprise Program in making wood available to secondary manufacturers and possible expansion of that program;
- changes in the marketing approach, promotional emphasis on remanufactured products and the promotion of foreign joint venture participation;
- detailed analysis of current uses of British Columbia's lumber.

CHAPTER J3

EXPANSION OPPORTUNITIES IN BRITISH COLUMBIA FOR HIGHER VALUED PAPERS AND PAPERBOARDS

EXECUTIVE SUMMARY

The potential for British Columbia's forest industry to expand in higher value pulp and papers has received increasing attention in recent years. Higher value products are perceived as one of the solutions for achieving further growth in this industry. In addition, higher value products are associated with an expectation of improved levels of average profitability. This issue has gained prominance because of the very severe downturn, between 1980 and 1983, in the total value of the province's traditional pulp and paper exports - softwood market pulp and newsprint.

These are the products which, together with softwood lumber exports, have been principal contributors to the forest industry's growth in British Columbia, and to the provincial economy. But for the first time in many decades, the forest products manufacturing sector has not contributed nearly to the extent that it usually does to the recovery phase of British Columbia's economic cycle. As a result, the current economic recovery in British Columbia has been very shallow and still appears to be uncertain.

The situation facing the forest products industry is not unique to British Columbia. Overcapacity in newsprint and pulp in the 1981-83 period was a global problem. It was linked to the considerably lower rates of economic growth and consumption levels in major economies.

Due to a strong U.S. economy and U.S. import demand, British Columbia's newsprint mills currently are operating close to maximum capacity. There has been a significant recovery also in market pulp demand and export prices are now close to their pre-recession levels. Unfortunately, despite record volumes of output, the lumber sector is still suffering from extremely low market prices.

The linkage between the wood products sector (lumber and plywood) and the pulp and paper sector is an important one. Increased lumber exports and higher prices normally lead the recovery, with growth in market pulp exports contributing strongly to corporate earnings with a lag of 6-9 months. Traditionally, newsprint has been a reasonably consistent contributor to cash flow, less prone to market downturns. This recent cycle has been a dramatic departure from this pattern.

Nevertheless, the slow growth in economic conditions prevailing in many export markets outside the U.S. do not account for all the problems that are occurring. Various structural changes are taking place in supply and demand, and in international competitive positions. There is little doubt that softwood market pulp and standard grade newsprint, the grade used for daily and weekly newspapers, will continue to be the cornerstones of British Columbia's pulp and paper sector for the foreseeable future. There is nevertheless a shifting of emphasis in British Columbia's competitive position which is pushing it towards capacity growth in higher value products.

This study identifies where this is taking place and measures the extent to which production of higher value products has developed over the pest decade. The study analyzes the market and technical (as determined by British Columbias fibre resources and so on) potential for further growth in higher value papers and boards. It evaluates the various constraints facing producers, or potential producers, in British Columbia and arrives at an assessment of the "realistic potential" for the industry.

British Columbia's Pulp and Paper Sector has Increased its Output of Higher Value Products

Analysis of British Columbia's pulp and paper sector shows that it is evolving towards a growing proportion of higher value products. "Higher" and "lower" have evaluative connotations and higher value is not necessarily synonymous with higher profitability. Moreover, products regarded as higher value in British Columbia's context often would be regarded as lower value in the context of production in countries such as Japan, the U.S. and many parts of Western Europe. Nevertheless, in relative terms, for British Columbia:

> lower value papers include standard grade newsprint; sack kraft and linerboard,
>
> higher value papers include fine papers, tissues and groundwood specialties.

The estimated net value of British Columbia's pulp and paper output in 1983, measured as sales value net of transportation, was over $2.5 billion. This was three and one half times the value of the sector's output in 1972. When adjusted for inflation, the value of pulp and paper output increased significantly over this period. In real terms, the value of output increased on average by 2.3% annually. Market pulp output accounted for 56% of the total value of the sector's output in 1983. Lower value papers accounted for about 33%. Higher value papers have increased their share of overall pulp and paper output in recent years and, in 1983, accounted for 11% of the total (Figure A).

If market pulp is excluded, however, higher value papers have increased as a percentage of total paper output, in dollar terms. Figure B shows that there has been significant growth in higher value paper output since 1975.

Figure A

VALUE OF OUTPUT OF MARKET PULP AND PAPERS PRODUCED IN B.C.

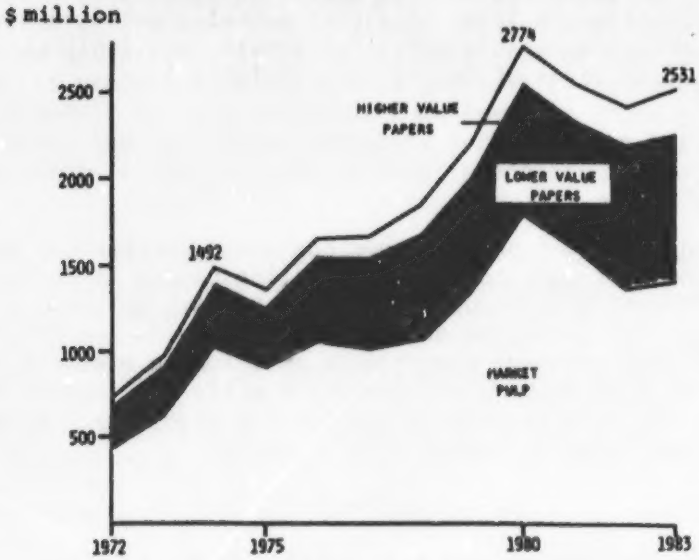
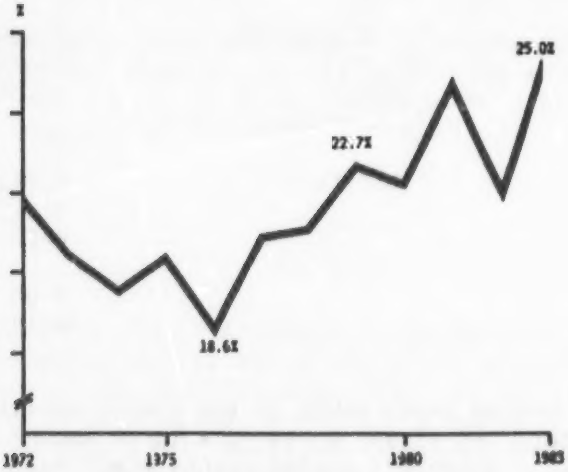


Figure B

HIGHER VALUE PAPER AS A PERCENTAGE OF TOTAL PAPER OUTPUT IN BRITISH COLUMBIA



The major components of this growth were higher sales values in tissues (Scott Paper) and fine papers (Island Paper Mills) which principally serve domestic markets. In addition, MacMillan Bloedel, and to a lesser extent B.C. Forest Products more recently, have increased output, and exports, of groundwood specialty papers. Figure B indicates that, in 1983, 25% of British Columbia's paper output was in the higher value grades. Recent sizeable capacity additions have been undertaken in all three higher value grades and increased output is forecast over the next few years.

British Columbia Has Growth Opportunities in Paper and Paperboard

There are a number of paper and board grades in which British Columbia has a weak competitive position in terms of export market growth. However, there are others which offer favourable potential growth opportunities. Possible products are ranked in terms of feasibility in Table 1.

HIGH POTENTIAL

Wood-Containing Grades

Wood-containing paper is defined as paper containing mechanical pulps, usually over 10%. The growth of wood-containing printing papers is considered to represent a significant growth opportunity for British Columbia's industry. It represents a natural extension of newsprint and builds on British Columbia's strong international competitive position in electric power. In addition, all of British Columibia's newsprint mills are located on the coast and all have deep sea port facilities, which is a significant advantage in the cost of handling and shipping higher valued papers.

Table 1

Initial Ranking of Higher Value Product Options
for B.C.'s Pulp and Paper Industry
(1984-90)

High Potential	Moderate Potential	Low or Zero Potential
Specialty Kraft Pulps	Solid Bleached Boards (depends on a technological change)	Commodity Grade Fine Papers aimed at export markets
Lightweight Coated Paper	Fluff Pulp	A major expansion in tissues aimed at export markets
Supercalendered Offset Papers		High valued chemical-pulp based specialties

LWC: Light weight coated paper (LWC) is the lowest quality grade of coated, wood-containing paper. It always contains a large amount of mechanical pulp. On a relative basis, lightweight coated papers (LWC) have been growing faster than any other major commodity printing paper. The western European paper industry (particularly the Finnish industry) and the U.S. paper industry have capitalized strongly on this growth. However, in spite of the large recent capacity increases, LWC demand currently exceeds available supply. This is the clearest opportunity for British Columbia's industry to move into a higher valued commodity grade paper.

SC Offset: Supercalendered offset paper (SC Offset) is a type of uncoated groundwood specialty paper developed in Finland. Prior to this breakthrough, the use of supercalendered paper was restricted to the rotogravure printing process. Uncoated groundwood specialties are the most straightforward paper options beyond newsprint. As a result, three out of four British Columbia newsprint mills produce some groundwood specialties, although only one company (MacMillan Bloedel) has a significant commitment to these grades in volume terms. However, the specific opportunity arrived at in this analysis, SC offset, represents a considerable advance in process technology and product quality.

Specialty Pulps: Some British Columbia companies have recently restructured their marketing approach and have upgraded their pulp mill processing to capitalize on this opportunity.

The advantages of focusing on specialty pulps are:

(1) better feedback from the market,
(2) higher value per tonne of pulp (although this also involves higher costs), and
(3) more stable markets during economic downturns.

From the viewpoint of future opportunities in higher value paper and paperboard, all these are positive factors. The first provides an enhanced appreciation of market opportunities; the second focuses on quality (increasingly important in the move to higher value); the third provides a healthier environment for continuing investment (product life cycle generally becomes shorter as value is added).

Opportunities for specialty pulps will depend to a large degree on the present customer base for British Columbia's market pulp. The wood-free printing paper and specialty paper mills in export markets would be the most receptive to specialty pulps from British Columbia.

MODERATE POTENTIAL

Fluff Pulp

Fluff pulp is produced for use in absorbent products such as baby diapers and sanitary hygiene products. Nearly all of the fluff pulp consumed in the United States is sold as low density, roll pulp. In contrast, the bleached softwood kraft market pulp produced in British Columbia is sold in tightly compressed bales of sheets. This would not represent an opportunity for a paper product, but could imply an opportunity for the market pulp industry. Fluff pulp is experiencing strong growth throughout every region of the industrialized world. At present, fluff pulp produced in the U.S. South (from pine) is available at a competitive price. However, it is anticipated that if, as expected, U.S. South producers gradually switch capacity to higher value products, fluff pulp could become a viable opportunity particularly for British Columbia's market pulp capacity. An additional factor is that many products (e.g. adult incontinence goods) require a less bulky, but still highly absorbent, fibre. British Columbia's fibres could be well suited in this respect.

Bleached Board (SBS): In some respects, bleached board represents the greatest technological challenge for British Columbia's industry. Whereas LWC and SC papers are designed to serve an upgraded market from newsprint (some customers for newsprint would also be customers for LWC and SC), the production of bleached board would require the integration of a market bleached kraft pulp mill. It would also require the addition of new pulping technology (e.g. CTMP), and a significant addition to the customer base (unless a joint venture involving a present market kraft buyer was obtained). The marketing infrastructure would also require a more significant change for the bleached kraft pulp producer adding bleached board to the product line compared with the newsprint producer adding LWC or SC paper.

LOW POTENTIAL

Wood-Free Papers

In terms of major export market opportunities, there appears to be little opportunity for British Columbia in the wood-free grades, coated or uncoated, in spite of a healthy projected increase in the demand for wood-free grades in the U.S.A. These grades require a furnish content of at least 60% hardwood bleached kraft pulp (BKP) to be competitive on a quality basis. A number of wood-free printing papers are produced with no softwood BKP and, with the lack of hardwood pulping capacity available to British Columbia's producers at an economic level, this is a significant competitive constraint for British Columbia's wood-free paper producers.

As part of the current restructuring in the U.S. South industry, there is considerable expansion of capacity taking place in wood-free uncoated paper. Some major companies in the U.S. South have identified uncoated wood-free papers as a growth market. In the past few years, a number of market pulp producers, faced with rising softwood fibre costs in their area, have integrated forward into the production of these grades: frequently using lower cost hardwood pulps. In uncoated wood-free grades, the recent capacity increases in the U.S. have placed it in a very cost-competitive position serving, firstly, its own domestic market needs and, secondly, expanding its export capability.

Paperboard

Paperboards, in general, do not represent as high valued a product opportunity as do printing papers. However, the recent trends are very definitely to higher valued paperboards. The improved quality and increasing competitive position of paperboard (a counter-response to earlier loss of market share to other materials) is resulting in penetration of the higher valued boards into other packaging materials (e.g. glass). In most cases, this is being accomplished by composite products.

A large portion of paperboard is produced from secondary fibre (waste paper), and is not relevant to the opportunities for British Columbia. The competition in these grades is intense and the higher valued recycled paperboards are facing increasing pressure from regulations (e.g. the U.S. Federal Drug Administration) to meet increasingly rigid specifications for food grade packaging. British Columbia has an inherent disadvantage in grades based on waste paper; the relatively small population of major British Columbia centres will not generate sufficient waste to be competitive for growth in these products.

Tissue and Absorbent Grades

The majority of tissue producers are nonintegrated, and the vast majority of tissue production throughout the world is consumed domestically. The finished (i.e. converted) products are bulky; thus handling and distribution preclude any significant volume of exports over long distances. However, tissue demand has been growing steadily and some absorbent products, such as adult incontinence goods (i.e. adult diapers), are likely to continue to experience strong growth.

In spite of the lack of opportunity for significant export of finished tissue products, there could be growth in exports of the semi-finished forms (as Scott Paper does at present). Moreover, there will continue to be a growth in the demand for finished tissue in western Canada. This market can readily be served by British Columbia's industry; thus this sector should continue to experience growth in domestic and some selected export markets.

Specialty Papers

In relation to British Columbia's present product base, these products represent a "quantum" jump in terms of technology, operation and marketing. British Columbia has few, if any, fundamental strengths in these grades which would support this direction of development. These papers do not represent a meaningful opportunity for British Columbia's industry.

Realistic Potential

Although some higher value products have been ranked as having high potential for British Columbia, there are various factors which will have a key influence on whether or not these opportunities will be realized. Some factors are expected to have an increasingly favourable influence, or at least less of an unfavourable influence. Others could preclude possible new investments.

The positive factors include:

1. British Columbia's Power Costs

   Canada has some of the lowest purchased power costs in the world. Power is British Columbia's strongest comparative advantage on an international basis, but British Columbia has fallen behind many other regions of Canada which actively encourage their industries to build up their product base on power- intensive technologies. The large increases in purchased power costs in British Columbia over the last 5 years have discouraged the industry in this respect. Most companies acknowledge the potential for capitalizing on British Columbia's favourable energy costs but are uncertain that this cost advantage will continue over the longer term.

Hydro policies in other provinces are very supportive of industrial expansion. In recent years, a number of provinces have shown considerable willingness to negotiate with industry structural capital requirements for increased power utilization (this is, for example, the policy of Alberta and Quebec). In British Columbia' s case, comparable policies are essential and must be communicated to industry to have a realistic chance of meeting the potential growth of the higher value paper products indicated in this study.

2. British Columbia's Wood Costs

British Columbia's wood costs are very competitive in the interior for its present product mix. Coastal wood costs are high relating to the production of bleached kraft pulp (BKP). Technologies and products (such as newsprint, LWC and SC papers) that are less dependent on wood and more dependent on power and are of higher value on a per unit of wood cost basis should place British Columbia in a more competitive position. In a global context, British Columbia is still in a strong wood quality and cost position compared with many of the developed regions of the world. This suggests that a number of British Columbia installations will remain competitive in newsprint and BKP. However, the competitive edge could be significantly improved by emphasizing capacity growth in the next higher valued level of commodities (as identified above).

The factors becoming less unfavourable include:

3. British Columbia's Distribution Costs

Freight costs appear to be decreasing under deregulation in the U.S. after having experienced real increases throughout the 1970's. Deregulation of the U.S. industry and falling oil prices are resulting in transportaton costs becoming less of a dominant factor.

4. Tariffs in Major Export Markets

In the past, comparatively high tariffs have been imposed by countries wishing to protect their domestic papermaking industries. However, the tariff constraint is declining in most cases. By the end of the 1980's they will be at very minimal levels in most cases and should not pose any serious disincentive to exports from countries which are cost competitive in paper/board making.

The potentially unfavourable factors include:

5. Sizeable Capital Requirements

The capital required to achieve the expanding product profile indicated in this report is made up of two components:

(1) the cost to modernize the existing mills, particularly the coastal market pulp mills
(2) the cost of producing the new products by one of three options:

- conversion of existing paper or pulp machines
- expansions at existing mills
- greenfield capacity in new mills.

In terms of capital, process changes involve a lower capital cost than product changes i.e. as a rule changes at the paper machine are more costly than changes to the pulpmill. It is clear from the above estimates that the cost of changing the product of British Columbia's pulp and paper industry will be substantial.

6. Perceived Business Climate

Apart from the various international factors discussed, British Columbia's attractiveness as an area for major investment in the pulp and paper sector appears to have been eclipsed for another important reason - deterioration of British Columbia's business climate.

In the past few years, many supply areas in competition with British Columbia have taken some unprecedented steps to attract new investments into their areas and to encourage existing industry to expand in higher value products. These steps include a wide range of incentives ranging from information packages for specific sectors (e.g. quantifying favourable investment conditions) to comprehensive financial and taxation treatment. In the pulp and paper industry specifically, there has been a major and positive shift in the attitude of local and state/provincial governments to this sector compared with a decade ago.

In the buoyant demand conditions of the early 1970's, when very favourable growth rates were anticipated to continue for a wide range of products, it was comparatively easy to attract new corporate investment. Today, the situation has been reversed. Companies are selective in their investments and they are attracted to those areas which offer the greatest potential for success and which minimize the business risks inherent in new ventures.

In the context of higher value papers, for example, it is essential for a producer to be able to guarantee continuity of supply to the purchasers of these products. For example, there is a growing volume of magazine publishing and commercial printing in one of British Columbia's markets - the U.S. West Coast. These types of business try to minimize the amount of capital tied up, for example, in higher value publication paper inventory (e.g. light weight coated) and they face major penalties (e.g. loss of circulation, loss of advertizing revenues and so on) if supply continuity, or quality is disturbed for any reason.

This is only one essential factor which has to be considered with regard to the production of higher value papers. There are many others. The risk factors are greater in the move to higher valued products. Grade specifications become tighter, and product handling becomes more critical. The potential for profit is relatively greater, but the potential for failure is also greater.

Areas which offer the best investment climate usually are the first to attract new investment. British Columbia's recent history has not been good in this respect and, compared with earlier decades, only a limited amount of new investment has taken place in the pulp and paper industry over the past ten years. Clearly, initiatives are needed to create the positive business climate that would do a great deal to enhance British Columbia's attractiveness for higher value paper and paperboard production.

CHAPTER J4

STATUS OF BRITISH COLUMBIA'S COASTAL FOREST INDUSTRY

SUMMARY

PREFACE

The terms of reference for this report required that an evaluation be made of the current status of the Coastal forest industry and opinions be given in the future configuration and competitive position of the industry based on future wood supplies, markets and trends. The report analyses and interprets the general status and trends on the basis of the consultants' opinions and judgment. The report does not attempt to analyse in precise detail all the public and private data available but provides the consultants' opinion of the current status and probable future trends of the industry.

INTRODUCTION AND BACKGROUND

The world economy experienced a traumatic dislocation in approximately 1980. The effects of this dislocation led to higher interest rates in both real and nominal terms and a slowing of economic growth. Reduced growth and actual declines in economic activity further increased fiscal deficits, putting additional upward pressure on interest rates, as deficits were financed. The impacts of this were particularly severe on industries which tend to be marginal suppliers in exposed export markets. This has been especially exemplified in the case of the coastal forest industry. These external economic factors have combined with domestic and other factors to create the present severe constraints on this sector of the forest industry. Internal factors have included rising real costs of production, sporadic work stoppages, a contraction of the desirability and marginality of the resource base, drastic deterioration of industry capital structures, and reduced product demand. Thus, the coast forest industry faces the problems created by the general economic climate, which indicates a slow recovery, its own debt problems, its unstable operating history and the improbability of being bailed out by the resource scarcity.

PRESENT STATUS OF THE INDUSTRY

Forest Resource Base

The coastal industry faces continuing trends of declining species desirability, declining log grades and increasing harvesting costs. These trends have largely been the result of the practice of harvesting the best and most accessible stands first. This practice has tended to force operations to steeper slopes and higher elevations where timber is generally smaller and logging conditions are more adverse. These negative trends, after many years, are moderating and approaching stability. In the long term, it is indicated that the greatest challenge to be faced by the coastal forest industry will be the profitable conversion of a log mix which contains 60% hemlock and balsam. Generally speaking, operators will be harvesting virgin timber for at least 20 to 40 years. To the turn of the century, there will be a gradual increase in harvest of second growth stands at which time this harvest will accelerate. This resource will not have a significant impact on timber supplies and costs. Of all the coastal species, the real challenge is focused on the cost and price problems of the "hembal" log mix, particularly the hemlock component. Graphs 1, 2, 3 and 4 illustrate the species shift towards hemlock and balsam, the log grade decline of hemlock and logging cost increases.

Product and Plant Obsolescence

All segments of the coastal forest industry tend to be characterized by aging manufacturing facilities. The industry is not fundamentally obsolete but many plants have been in place for decades and despite upgrading and modernizing investments, obsolescence has crept in simply because of the passage of time. This obsolescence factor is particularly characteristic of the whole plywood industry, much of the pulp industry and portions of the lumber industry.

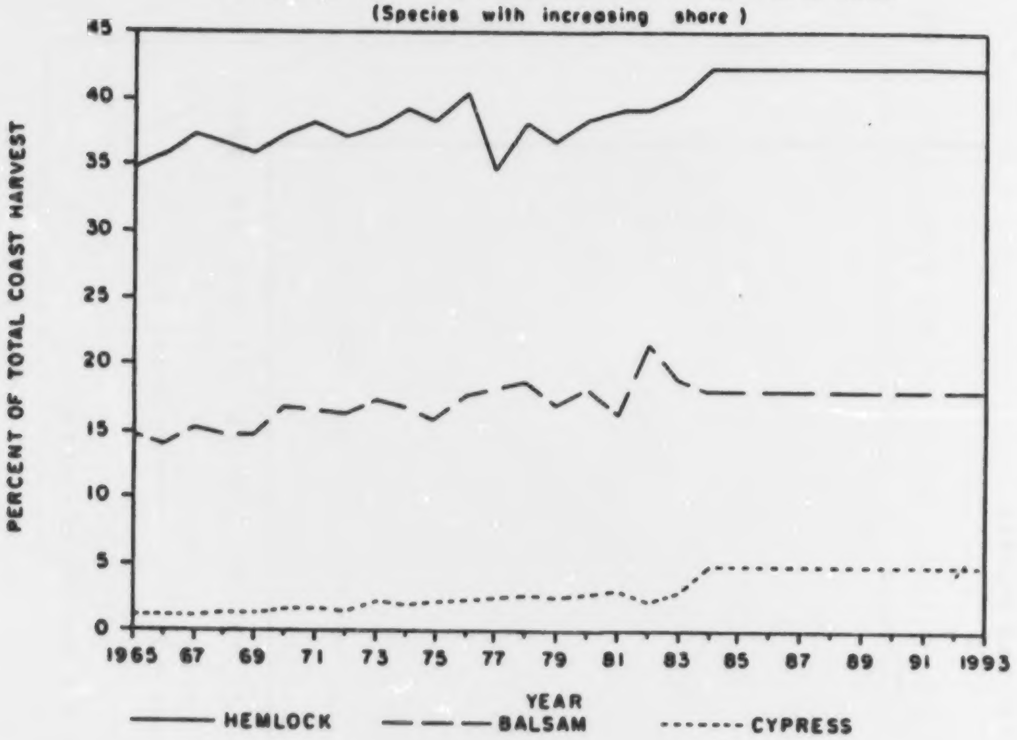
It must be emphasized in this context that the coastal forest industry is not generally comparable with the interior forest industry. The resource bases are largely different. Additionally, the interior industry is primarily "cost driven" in a largely commodity oriented market while the coast industry is primarily "product driven" in diverse, fractional specialty markets.

All evidence indicates that the traditional coastal plywood industry is in a state of terminal decline. It is expected that this decline will be steady and that by the turn of the century, no more than one or two plants producing specialty products will remain in production. The most important factors causing this decline are high log and conversion costs and product obsolescence.

Both the pulp and lumber sectors suffer acknowledged obsolescence ranging from very severe to minimal. In addition, both sectors tend to be near the top of the range in international cost rankings. Both sectors face the challenge of having limited opportunity to reduce costs combined with the existence of general capital starvation. The opportunities to reduce costs and improve productivity are therefore severely limited.

Market and Competitive Factors

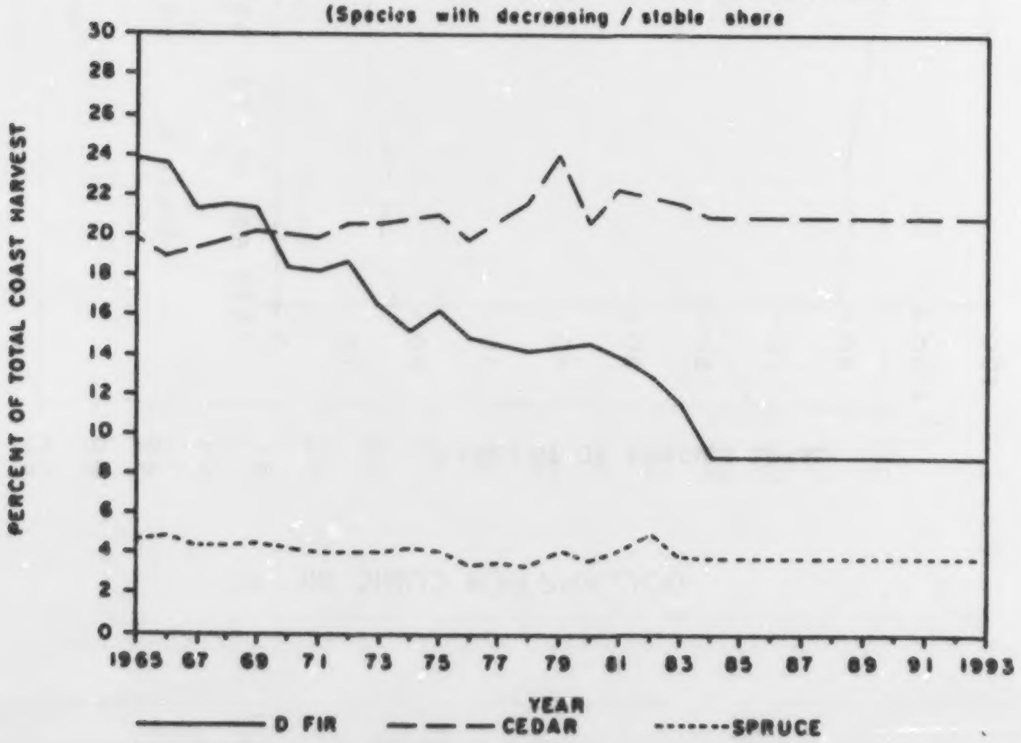
The coastal forest industry has suffered from and continues to face major external uncontrollable competitive factors such as currency exchange rates and competition by countries with artificial economies. Examples of this are Scandanavian currency devaluation and the recent "dumping" of pulp and newsprint by East Block countries in the California market. The survival of the coastal lumber industry requires a continued access to historic offshore markets. Despite the factors noted above, the existing supply of old growth timber provides a distinct advantage. British Columbia's coast and the U.S. Northwest realistically contain the world's remaining supplies of this old growth resource. This allows a sustained presence in these specialized product markets. The other producers in Canada, including the interior industry and plantation based foreign producers tend to be largely excluded by virtue of the nature of their resource. The old growth timber supply provides



Graph 1

COAST HARVEST BY SPECIES

(Species with increasing share)



Graph 2

COAST HARVEST BY SPECIES

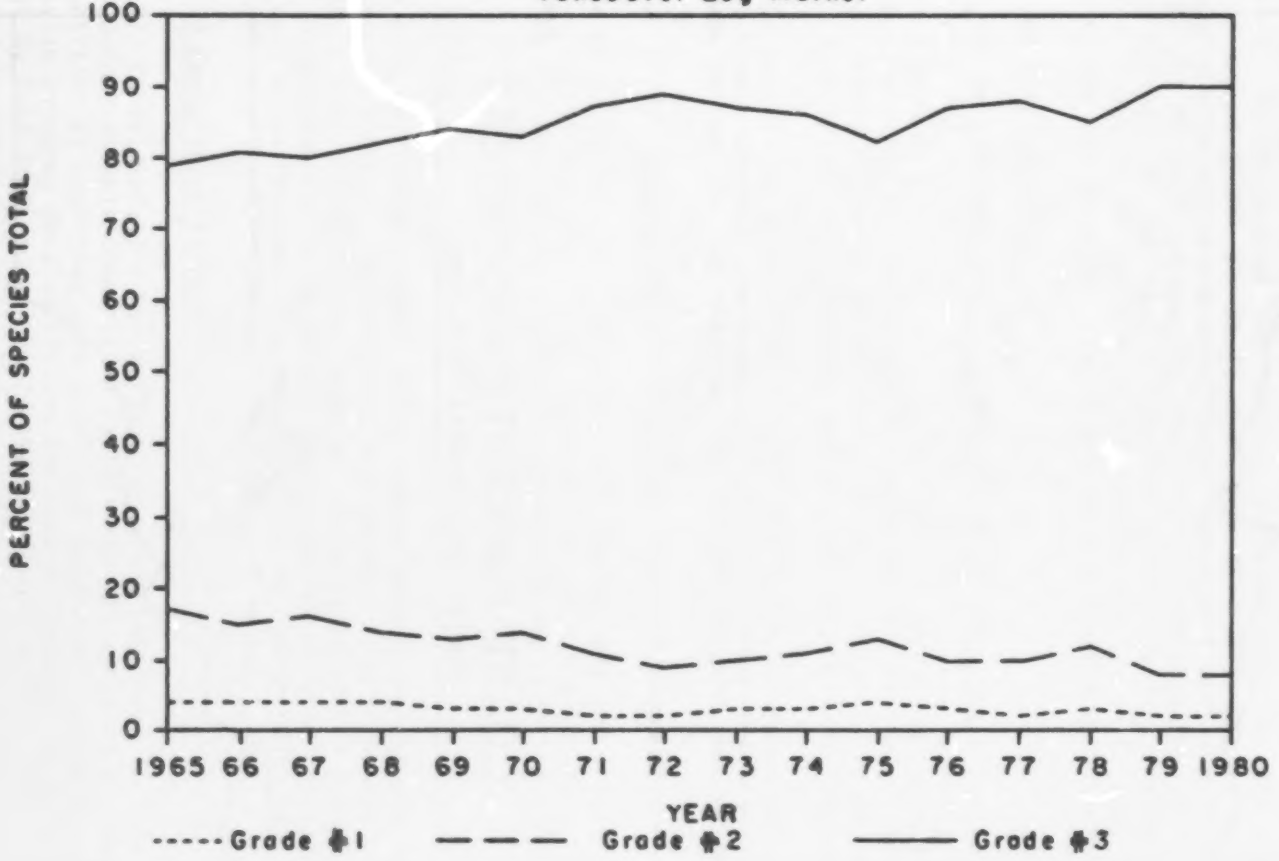
(Species with decreasing / stable share

Source : C.O.F.I. and Ministry of Forests

Graph 3

HEMLOCK LOG GRADE DISTRIBUTION

Vancouver Log Market

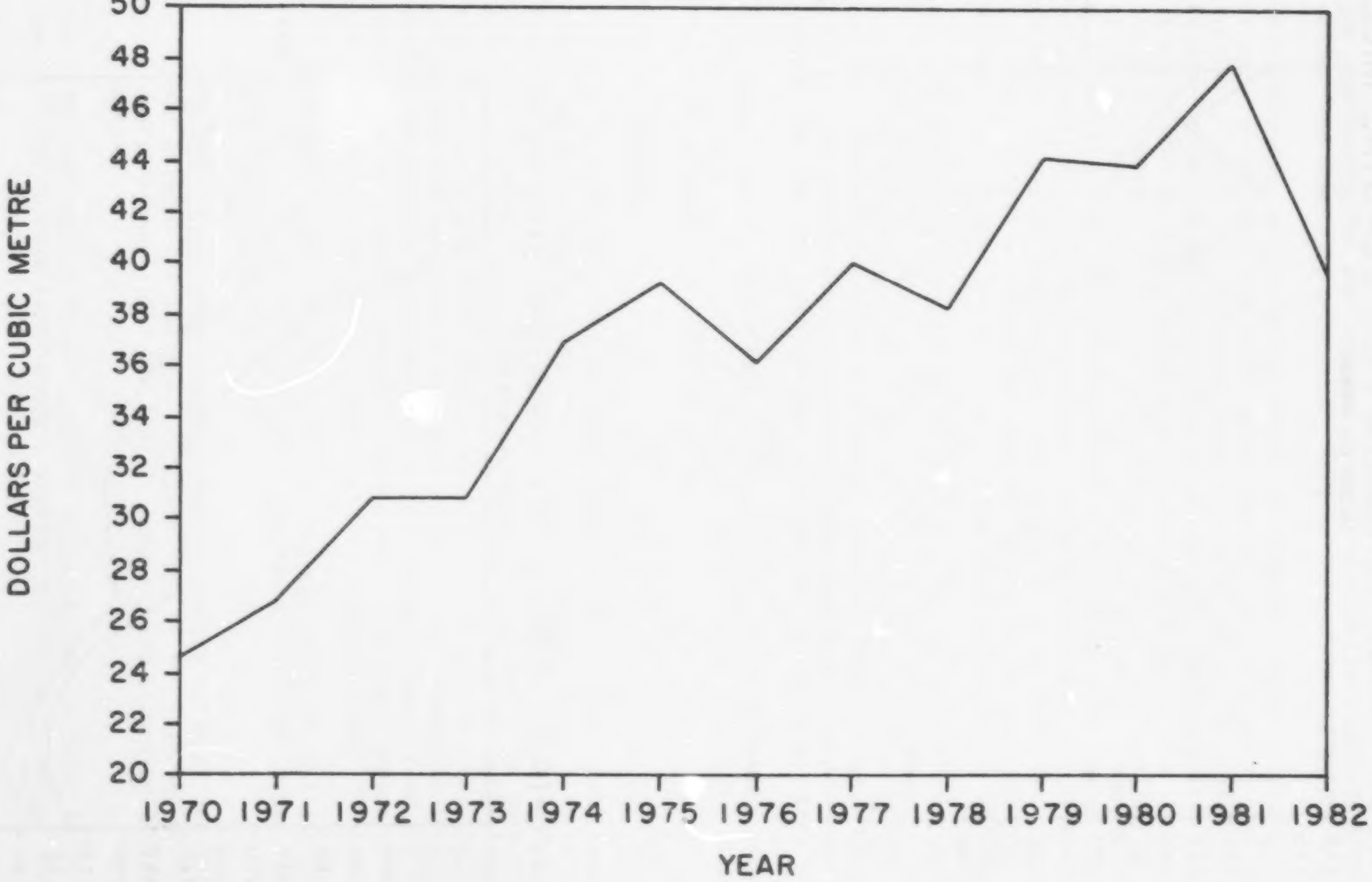


Source: C.O.F.I. and Ministry of Forests

Graph 4

COAST LOGGING COST,(1) 1982 DOLLARS

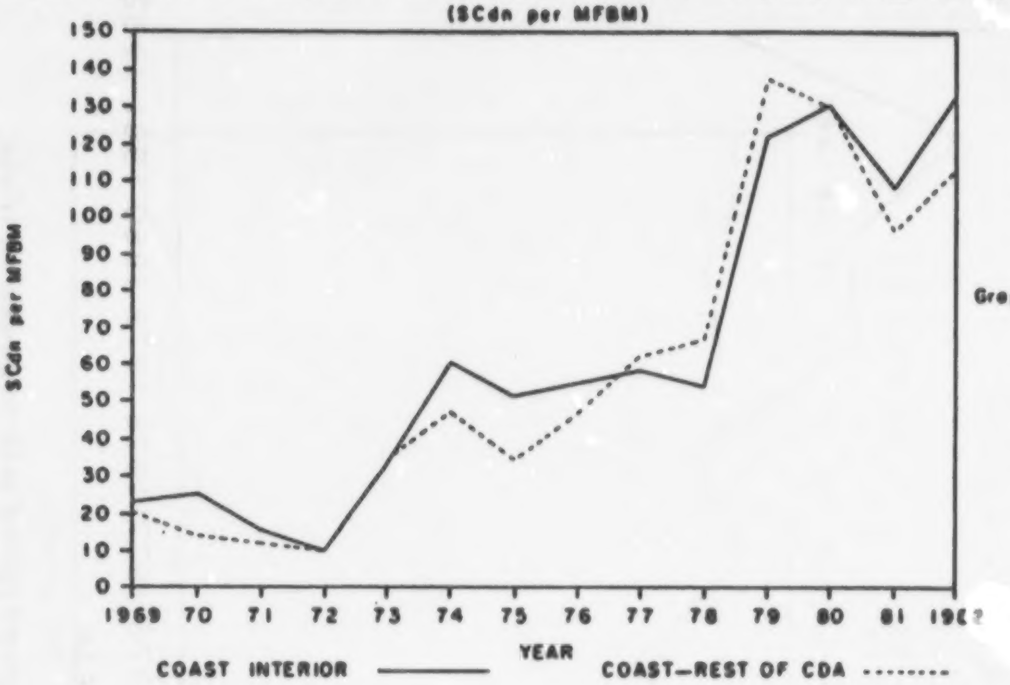
(constant 1982 dollars per cubic metre)



(1) Includes salaries and wages, materials, fuel and electricity less purchase wood and stumpage and royalty. Does not include depreciation, interest, etc.

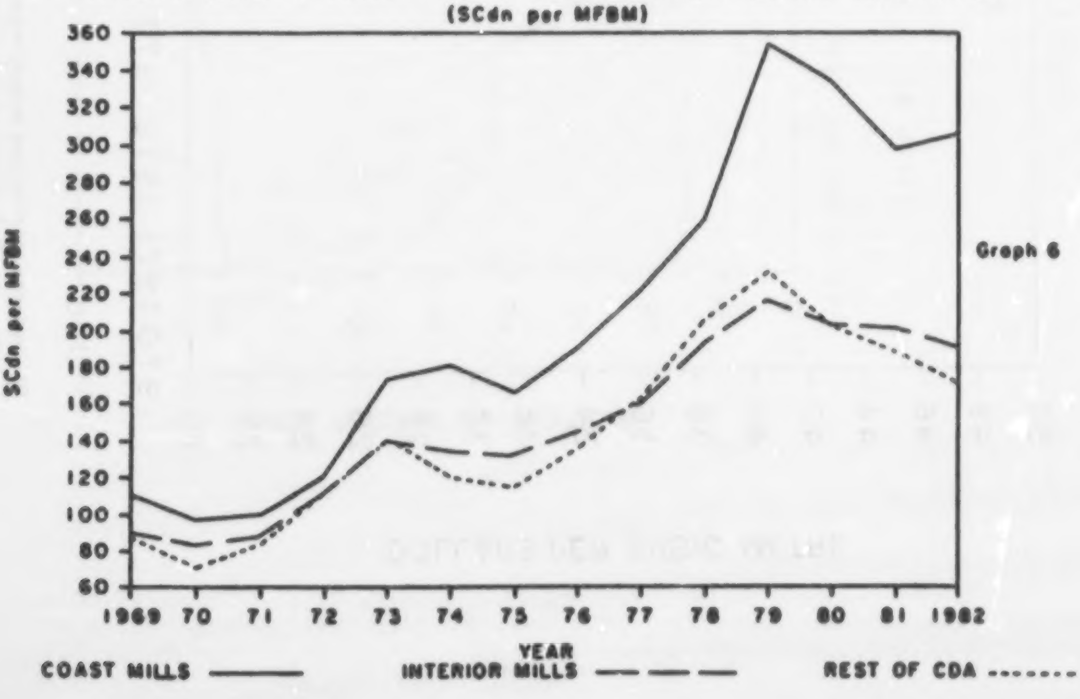
Source: Statistics Canada

LUMBER PRICE PREMIUM FOR COASTAL MILLS



Graph 5

AVERAGE PRICE ON LUMBER SHIPMENTS



Graph 6

Source: Statistics Canada

the opportunity for the industry using this resource to obtain higher product values than commodity producers. This is illustrated by graphs 5 and 6.

The opportunity exists to improve these favourable differentials. For example, during the last five years, the recovery of clears, shop and specialty lumber has increased from 6.7% to 17.7% of the product mix. Evidence from overseas conversion of export logs indicates that recovery levels of 30% to 40% of these products are achievable. The coastal industry therefore appears to have an advantage by virtue of the quality of the resource. The major threat to this advantage could come from the U.S. North West, which due to the better quality of its resource is the only area capable of matching or exceeding the production of these higher value products. This threat will become real in the event that U.S. priorities shift from domestic to export markets or allowable cuts are raised in National Forests in the Western U.S. A real potential exists for both these events to materialize.

Historic quality advantages of coastal pulp are no longer significant factors in export markets. Apart from unforeseen changes in external factors such as currency exchange rates, the continued survival of the pulp sector is largely dependent on the control of the production costs, particularly that of fibre supply. The evidence of a worsening fibre supply deficit in the pulp industry renders the option of fibre supply cost reduction improbable.

In summary, all sectors of the coastal industry are exposed to severe uncontrollable external factors and a limited range of opportunities exist to reduce or control costs domestically.

Capital Factors

Since 1979, there has been a drastic decline in the financial strength of those companies heavily concentrated in the coastal forest industry. This decline has been particularly severe in the traditionally more dynamic, risk-taking companies. Some of the more cautious companies have retained fairly healthy balance sheets but profit margins are so low that their financial positions will continue to deteriorate on a relative basis in comparison with competitors in other regions. To illustrate this trend, a simplified analysis was conducted of the capital structure of eight public coastal forest products companies whose AAC's represent approximately 75% of the total AAC on the coast. This analysis revealed that:

- In 1979, public companies had an average ratio of debt and preferred shares to total capitalization (excluding deferred income tax) of 31% and ranged from 12% to 39%.
- In 1983, these same companies had an average ratio of 56% and the range was between 34% and 99%. If the effect of the issuance of new common shares between 1979 and 1983 is removed, the situation is substantially worse.

The remaining coastal forest products companies not included in this analysis are believed to have experienced a similar decline in financial strength.

The result of this traumatic change in financial strength has resulted in an industry which can be approximately categorized as follows:

Debt/Capital Ratio	Portion of Total Industry (on basis of timber supply)
up to 50%	20%
51% to 75%	60%
76% to 100%	20%

The effect of the financial decline of the industry is that there exists little means for new investment by 80% of the coastal industry. Only 30% enjoy relatively healthy balance sheets while 20% is in grave financial peril. Other implications are:

- Worsening institutional and investor concerns regarding debt security and earnings make it extremely difficult for up to 80% of the industry to raise capital on acceptable terms;
- The consequent possibility of unavoidable further concentration and domestic integration dictated by financial necessity which is counter to traditional public policy;
- The probability of further bankruptcies, in addition to those which have already occurred, in the coastal sector.

The likely long term effect will be to reduce the scope of a large portion of the surviving industry to remain competitive by overcoming obsolescence and optimizing product outturn.

TRENDS AND INTERACTIONS

Historic factors, resource factors, competitive factors and financial factors have converged adversely on the coastal industry. The net effects indicate certain probable future trends in various sectors of the industry and consequent interactions between sectors.

The Resource Base

For illustrative purposes, the effect of adverse convergence of factors noted above are demonstrated in Graph 7 which presents the coastal log supply curve.

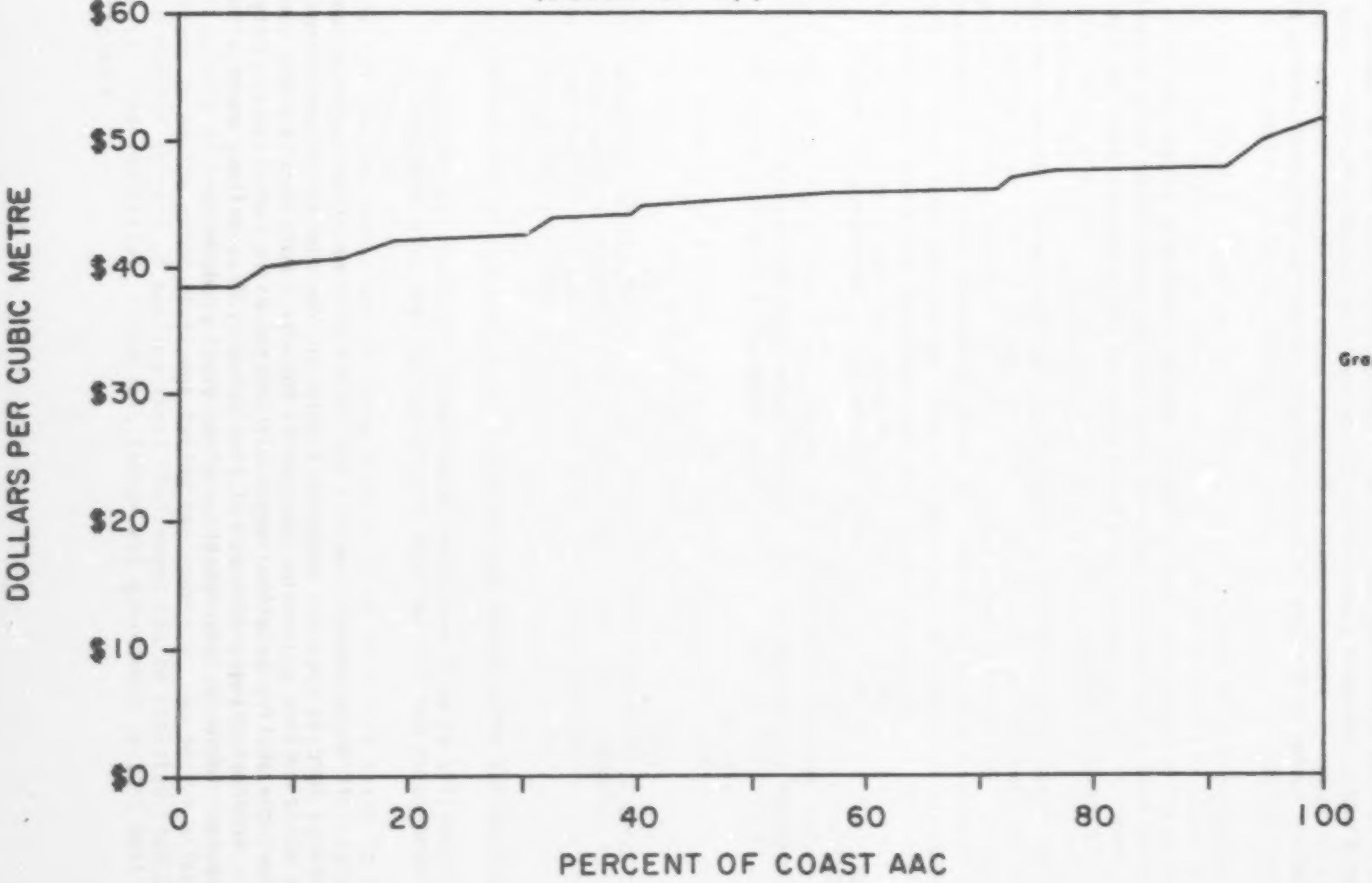
The supply curve comparatively is very flat. This indicates that a small change in the real price of logs will result in a large decrease in log supply. For example, a real long term decrease of price of $5 per cubic metre could render approximately 30% of the coastal cut uneconomic. A trend to a decline of coastal cut of approximately 20-25% below the 1980 production level is therefore foreseeable, unless the major adverse factors, already noted, change.

Plywood Sector

The trend is for terminal decline for the plywood industry in the long term. The result will be a loss of employment base and a diversion of higher value logs either to the lumber sector or to log export. Either of these log supply diversions contain potential advantages to the residual industry.

COAST SUPPLY CURVE FOR LOGS, BY SYU

(based on appraised LCAs)



Graph 7

Source : Ministry of Forests

Lumber Sector

The combination of factors noted indicate a trend of decline in lumber production to approximately 80% of the 1980 level. This is likely to occur mostly in the non-integrated sector. Consequences will be a shrinkage of chip supply and a downward pressure on log prices. A probably further trend will be a decrease in lumber recovery factors (and a consequent increase in chip recovery factors) through industry efforts to recover proportionately higher lumber values.

Pulp Sector

Coastal pulp production will probably remain relatively stable but interactions affecting raw material supply may render older marginal mills uneconomic. The consequences of raw material interactions will impinge most heavily on this sector.

A pulp fibre supply deficit already exists on the coast. Stockpiled chip and pulp log inventories to meet this deficit appear largely to have been consumed. Options for importation of supplies, including those from the interior, are severely limited. With the predicted declines in log harvest and log conversion, the fibre deficit will worsen and tend to become chronic. A reduction in log harvest will have the impact of reducing pulp fibre availability in two ways: reduction of pulp log supply and reduction of by-product chips in the log conversion sector. The impact of this is illustrated in the following table.

Coast Log Harvest (% of 1976 to 1980 average) *1	Pulp Fibre Deficit (% of capacity) *2
100	9%
90	17%
80	26%
70	34%
50	50%

*1 - includes average current imports

*2 - capacity at peak operating conditions.
Indicated deficit includes both pulp logs and pulp chips.

Most of these indicated deficits will occur in the hembal mix and not in other species. If these deficits occur, the result will be either major price increases in pulp logs and by-product chips or the closure of some marginal pulp mills. Since conversion margins in the coast pulp industry are currently so low, the ability to afford major cost increases is unrealistic. Only a major external change, such as relative currency devaluation, would allow fibre cost increases and retention of marginal producers.

CONCLUSIONS

Since 1979, an array of external and internal adverse factors have converged on the coast forest industry. External factors are uncontrollable by the industry or the provincial government. However, most observers expect the currency situation to become more favourable over the next few years as North American interest rates decline. The options for control of domestic factors are limited generally to two categories:

Industry Control - Options are limited to extraction of higher product values and reduction of costs, including overcoming work stoppages and achieving other cost efficiencies in the labour sector. The coast lumber industry is oriented to the maximization of value recovery from a high quality resource base. Unit cost reductions are realistic through additional productivity gains. Further changes and modernization will be necessary but the industry is aware of the opportunities and the required changes and is moving with all possible haste generally in the right direction.

Government Control - Options include such items as possible general tax burden reductions and changes in provincial policy regarding management and harvesting of the forest resource.

Regulatory and policy options include:

- Reduction in stumpage especially in predominantly hemlock stands. The logical option (disregarding revenue considerations) is implementation of stand-as-a-whole stumpage appraisals.
- Adjustment of excessive physical forest utilization standards to better reflect current economic realities.
- Reduction of regulation of such items as rigid annual cut control requirements, excessive measurement functions, environmental burdens, combined with a general streamlining of overall procedures to reduce costly delays.
- Management of log export policy to reduce actual domestic log costs.
- Retention by government of probable reversion of presently allocated allowable annual cuts to provide for flexibility in future resouce and industrial policy.

In conclusion, the probable trend is for a restructured smaller industry and a reduced economically harvestable forest resource. The worst impact of adverse trends appears to be over. The surviving coast industry will continue to have a good resource base containing the structural advantage of sustained old growth timber supplies. Cost reductions in harvesting and conversion, particularly of hemlock and balsam stands, and recovery of higher values will continue to be the major challenge facing the industry. No sector affected by the potential success of meeting these challenges can be isolated from the process. The industrial, financial, labour and government sectors must all participate.